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THE UNIVERSITY OF ALBERTA

Acquisition and generalization of imitation among learners
with severe handicaps

by

Wendy Jean Sauve

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF Master of Education

Department of Educational Psychology

EDMONTON, ALBERTA

Spring, 1988

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Acquisition and generalization of imitation among learners with severe handicaps submitted by Wendy Jean Sauve in partial fulfilment of the requirements for the degree of Master of Education.

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March 14, 1988

Dedication

To Cecile Corbiell, who quietly supported my efforts

Abstract

The present study evaluated modelling as an instructional procedure used for teaching persons with severe handicaps. Modelling is used to teach a person to imitate the behavior of a model. The value of modelling as an instructional procedure for teaching persons with severe handicaps is dependent upon either directly teaching functional skills using modelling as the instructional method or teaching a generalized imitative response that will generalize to the performance of functional skills.

The purpose of this study was to investigate the relation between the acquisition of imitative behavior trained through modelling, and the generalization of the imitative response to other behaviors. The performance by persons with severe handicaps of behaviors they have been taught to imitate and the generalization of the imitative response to other behaviors was studied. The similarities and differences between the initial training tasks and the tasks to which the imitative response either did or did not generalize was evaluated.

The experimental subjects included four students, ages 5 to 13, with severe handicaps. Each student was taught by modelling and prompting to perform three tasks varying in the types of motor movements and materials used. Generalization of performance to tasks with both similar materials and motor movements (to the initial training tasks), similar motor movements but different materials, and

both different motor movements and materials were periodically assessed. The experimental design was an AB design with a replication of the study across subjects.

The results indicated that students' imitation of modelled and prompted tasks improved. The students also showed improvement in the performance of generalization tasks having materials and motor movements similar to those of the initial training tasks. The students showed some limited improvement in the performance of generalization tasks having motor movements similar to, but materials different from those of the initial training tasks. The students improved the least in their performance of generalization tasks having both materials and motor movements that differed from the training tasks.

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2

I. INTRODUCTION

Much of the purposive behavior that humans exhibit has been learned through a process of imitation. Significant persons in the environment provide models of behavior that are replicated. Some persons, however, are characterized by their failure to learn through the process of imitation.

Persons with severe handicaps are often unable to learn to imitate the behavior of models in their environment. Researchers have attempted to teach persons with severe handicaps to imitate using a structured instructional process. Although persons with severe handicaps have been able to learn to replicate some modelled behaviors (Altman, Talkington & Cleland, 1972; DeHaven, 1981; Furnell & Thomas, 1981; Giangreco, 1982; Gow, Ward, & Balla, 1985), much of the process of imitation by persons with severe handicaps has not been well researched.

Imitation is a complex behavior requiring both the ability to attend to the relevant characteristics of the behavior, and the motoric ability to reproduce the behavior. The more complex the relevant stimulus features or the more difficult the motoric requirements of the task, the less likely it is that imitation will occur (Bandura, 1966).

Learning to imitate a model would be advantageous to persons with severe handicaps if imitation training could increase their repertoire of useable skills (Brown, Nietupski & Hamre-Nietupski, 1976).

II. LITERATURE REVIEW

Persons with severe handicaps learn at a significantly slower rate than do their non-handicapped peers (Sailor & Guess, 1983). Therefore, it is most important that educators and researchers determine the best possible instructional methods for teaching the most important skills to these severely delayed learners.

Learners with severe handicaps are an extremely diverse group. Researchers have defined their subjects with severe handicaps in a variety of ways. Descriptions included subjects' medical diagnosis (DeHaven, 1981), physical disabilities (Waldo, Guess & Flanagan, 1982), I.Q., (Alberto, Jobes, Sizemore & Doran, 1980), communication skills and response to simple commands (Baer, Peterson & Sherman, 1967), ability to imitate (Garcia, Baer & Firestone, 1971; Hekkema & Freedman, 1978) or a combination of these characteristics. Gow et al. (1985) provided the most comprehensive description of their severely handicapped subjects by evaluating their language, manual dexterity, sight and hearing using a battery of tests.

Most learners with severe handicaps do, however, share some common characteristics. In addition to having significant developmental delays and a much slower rate of learning than their non-handicapped peers (Sailor et al., 1983), they are also usually unable to demonstrate a learned skill under altered conditions. An individual with severe handicaps may not perform a previously learned skill if the

setting, trainer, materials or cues are varied (Gaylord-Ross & Holvoet, 1985). This lack of performance of learned skills under varied conditions is referred to as an inability to generalize. The slow learning rate and inability to generalize which persons with severe handicaps exhibit has prompted educators and researchers to realize the importance of both the process and the content of instruction. However, researchers have often examined the instructional process for teaching learners with severe handicaps without regard for the content.

One instructional method for teaching learners with severe handicaps is modelling or imitation. Imitation is generally defined as a learner's ability to "copy or reproduce the actions or sounds of a model" (Bricker & Dennison, 1978, p. 167). Metz (1965) included three ~~conditions in the definition~~ of generalized imitation: the imitative behavior must be similar to and follow the model, the behavior must not have been previously controlled by the model of the behavior, and the appropriate behavior must occur in response to the model. Generalized imitation has been demonstrated when a learner performs a previously untaught behavior using a model of the behavior as the cue to perform the behavior.

Imitation training teaches the learner rule-following behavior (York, Williams & Brown, 1976). The trainer gives the learner a task command such as "Do this," models a behavior, and the learner imitates the behavior thus

demonstrating the rule "do as the model does". If, during training, a sufficient number of imitations are reinforced, the trainer may establish imitation as a generalized response so that imitation will be transferred to situations other than those initially trained (Kazdin, 1975).

Although studies have shown that it is possible to teach imitation to previously non-imitative learners, many aspects of generalized imitation have not been examined (Garcia et al., 1971). Bandura (1966) stated that factors such as motivation, prior discriminative training, and the distinctiveness of relevant modelling features such as the "rate, amount, and complexity of stimuli presented to the observer will partly determine the degree of imitative learning" (p. 330). The following studies have examined the effects of varying reinforcement, varying the types of behaviors modelled, or varying the instructional procedure on imitation and generalization learning for learners with severe handicaps.

Generalization of trained responses may be affected by the number of exemplars of the skill taught to the learner. Although generalization cannot be expected to occur automatically, it will often occur if sufficient exemplars of the skill have been trained. Stokes and Baer (1977) stated that "it is optimistic to note how frequently a sufficient number of exemplars is a small number.... Frequently it is no more than two" (p. 356).

A sufficient number of exemplars can be trained by either serial or concurrent task sequencing of instruction. Concurrent task training teaches two or more tasks during each training session (Sailor et al., 1983). Anderson and Spradlin (1980) used serial task sequencing to teach labelling of similar objects to a profoundly retarded adolescent. The learner was taught one example in each class of objects until criterion was reached, then tested for generalization to other members of the class. If the learner had not generalized, the researchers continued teaching and testing successive examples in the class until the learner had generalized to all members of that class. Even though the time required to teach each successive example to criterion was less than the previous one, Anderson et al. (1980) stated that "if the critical variable is simply ensuring that subjects experience a diversity of training examples, then a more efficient technique may be training several examples concurrently, instead of serially" (p. 155).

Two studies examining the effects of concurrent versus serial task sequencing found no differences in the number of trials to criterion for either method (Panyan & Hall, 1978; Schroeder & Baer, 1972). However, a study examining the acquisition of receptive labels found that more trials were required to reach criterion during concurrent trial sequencing as compared to serial trial sequencing (Waldo et al., 1982). All three studies found that concurrent trial

sequencing promoted generalization better than serial task sequencing.

Additional factors which may influence imitation learning are reinforcement and the type of task being trained. Bandura (1971) stated that a lack of imitation may be caused by inadequate reinforcement. Even though not all persons find the same items or events reinforcing (Snell & Smith, 1978), researchers training imitation often reinforced all of their subjects with the same items (for example, Bucher & Bowman, 1974; Garcia et al., 1971). Some researchers excluded subjects from their studies because the subjects were not-reinforceable by the items the researchers used in the study (for example, Martin, 1971; Schroeder et al., 1972). Snell et al. (1978) suggested that learners with severe handicaps should sample various potential reinforcers before the items or events are used as reinforcers.

Imitation and generalization may be affected by the type of task being trained. Although educators stress that education for learners with severe handicaps must "maximize the usefulness of each skill acquired" (Horner, Sprague & Wilcox, 1982, p. 63), few imitation studies have taught functional skills. Most imitation studies of individuals with handicaps have taught non-functional tasks such as chair turning (Altman et al., 1972), body movements such as tapping one's head (DeHaven, 1981; Furnell et al., 1981), or a combination of body movements, movements with objects, and vocal sounds or words (Baer et al., 1967; Bucher et al.,

1974; Furnell & Thomas, 1976; Garcia et al., 1971).

Persons with severe handicaps have been taught functional skills using imitation as the instructional procedure. Functional skills are chronologically age-appropriate, increase independence, and are useable in the learner's current environment or community (Brown et al., 1976). Gow et al. (1985) used verbal self-instruction and modelling, to teach adult males with moderate, severe and profound handicaps to make sandwiches, to vacuum, and to collate. Giangreco (1982) taught a profoundly handicapped boy to imitate fifteen tasks including turning on a faucet, pressing tape recorder switches, opening drawers and activating toys. Bender (1978) found that severely retarded children were able to learn psycho-motor vocational tasks through imitation training.

Using modelling as an instructional technique is useful if the behavior being taught by modelling is imitated and if the learner's ability to model generalizes to previously untrained behaviors. The learner should generalize imitation to untrained behaviors so that it is not necessary to directly teach the behavior. Learners with severe handicaps, however, are usually unable to generalize from trained behaviors to untrained behaviors varying in the setting, the trainers, or the materials (Gaylord-Ross et al., 1985). Therefore, the instructional time used to train learners with severe handicaps to imitate non-functional behaviors could be used more productively if functional skills or

behaviors were taught from the outset. In an evaluation of studies of functional and non-functional skill training, Berman and Oplaski (1984) found that "functional skills generalize more successfully than non-functional skills" (p. 23).

Topographical similarity of tasks may be a factor determining a learner's generalization of an imitative response to other tasks. Giangreco (1982) stated that topographical similarity is determined by "analyzing tasks in terms of their motor schemes" (p. 165). Steinman (1970a) and Garcia et al. (1971) found that untrained tasks topographically similar to the trained tasks were more likely to be imitated than topographically dissimilar tasks. Giangreco (1982), however, found that a profoundly mentally retarded boy taught to imitate functional tasks generalized imitation to three tasks which required different motor movements than the trained tasks.

Several researchers have suggested that imitation of tasks involving the use of objects were the easiest to learn (Kent, 1974; Whalen & Henker, 1971). Other researchers (Hingten & Churchill, 1970; Hingten, Coulter & Churchill, 1967) have found that the time required for training autistic children to imitate the use of objects was greater than the time required to teach vocal sounds and words, or movements of the body. However, the behaviors using objects taught by Hingten et al. (1970; 1967) were complex skills such as cutting with scissors or drawing a straight line,

while the body movements were simple movements such as clapping hands.

Skills taught to learners with severe handicaps must be chosen with care. The skills should be age-appropriate, increase independence and be useable in the learners environment (Brown et al., 1976). Instruction of the skills must "maximize the usefulness of each skill acquired and minimize the time spent in acquisition" (Horner et al., 1982, p. 65).

Skill acquisition is often restricted by an inability of students with severe handicaps to generalize (Gaylord-Ross et al., 1985). Although generalization does not automatically occur for students with severe handicaps (Stokes et al., 1977), these students have demonstrated the ability to generalize. Research has found that generalization was improved by teaching functional skills (Berman et al., 1984), using concurrent rather than serial trial sequencing during instruction (Panyan et al., 1978; Schroeder et al., 1972; Waldo et al., 1982), and teaching a number of exemplars of the skill (Stokes et al., 1977). One instructional method for students with severe handicaps requiring further investigation is generalized imitation (Garcia et al., 1971).

III. STATEMENT OF THE PROBLEM

A. Problem

This study examined the ability of students with severe handicaps to learn to imitate modelled tasks and to generalize this imitative response to other tasks. Three tasks that varied from each other in the materials used and in the motor movements required to perform them were taught to the students using modelling and prompting. Generalization tasks assessed the learner's ability to generalize the imitative response to the performance of tasks varying from the trained tasks in motor performance and/or the materials used.

B. Acquisition

Hypothesis I (Tasks 1-3) - Students with severe handicaps will improve performance of three tasks varying in materials and motor movements when prompted to imitate a model of each of the three tasks.

Rationale - Research has shown that learners with severe handicaps can learn to perform tasks if the task is modelled and the learners are prompted to complete the task (Garcia et al., 1971; Giangreco, 1982; Steinman, 1970a).

C. Generalization

Hypothesis IIa (Tasks 4-6) - Students will generalize a learned imitative response to other tasks using materials and motor movements similar to the initially trained tasks.

Hypothesis IIb (Tasks 7-9) - Students will generalize a learned imitative response to other tasks using motor movements similar to, but materials differing from the initially trained tasks.

Hypothesis IIc (Tasks 10-12) - Students will not generalize a learned imitative response to other tasks with different materials and motor movements than those used in the initially trained tasks.

Rationale - Research has shown that learners with severe handicaps are most likely to generalize an imitative response from one task to another when the tasks share many common characteristics (Gow, Ward & Balla, 1986; Livi & Ford, 1985). Conversely, the more differences between the tasks, the less likely that students will generalize imitation from one task to another.

D. Maintainance

Hypothesis III - No hypothesis regarding the maintainance of imitated tasks was formulated prior to the study. Only two published studies using imitation to teach tasks to learners with severe handicaps have evaluated maintainance. Giangreco (1982) found that the reinforcing function of tasks increased maintainance. Gow et al. (1986) found that

overlearning of tasks appeared to enhance maintainance. The maintainance of task performance is discussed later.

IV. METHOD

A. Selection of Subjects

Screening Tests

Screening tests were used to establish that each student had the minimum requirements necessary to complete each task. The students demonstrated adequate vision by reaching towards or picking up one of two reinforcers presented to them by the instructor. Motor ability was evaluated by observing the student's manipulation of objects used in the study. If the students were able to see, reach for, pick up and release all of the objects during the screening sessions, they were included as subjects in the study.

The screening tests also evaluated the student's reinforcer preferences. Five reinforcers were offered to each student so that it was possible to determine the reinforcer most preferred by each individual. Those items or events chosen most frequently were used as reinforcers throughout the study.

Subjects

The subjects were four students with severe handicaps attending the Elves Memorial Child Development Centre, Edmonton. The students were receiving instruction in basic skills such as self-help, beginning communication, and fine and gross motor. Sailor et al. (1983) defined students with severe handicaps as those students requiring instruction

primarily in basic skills, as opposed to academic instruction.

Six students were recommended for this study by the program directors. These were students who had not previously demonstrated the ability to imitate a modelled action. Two students were not included because they did not have the necessary prerequisite abilities as assessed in the screening tests. These two students were unable to lift and release the materials used in the study.

Written consent was obtained from the parent(s) of each student prior to their inclusion in this study. To maintain confidentiality, fictional names have been used to identify the students. The students who participated in this study are Ann, Hal, Alex, and Oliver.

Ann was a girl of 5 years, 1-month with severe handicaps. She communicated with non-specific vocalizations and smiling. When shown two pictures of preferred toys, she was able to point to one picture to request a toy.

Ann was able to crawl to students, adults, or toys in the classroom, and to pull herself to a standing position. Her teachers indicated that Ann was predominantly left-handed although she had been observed to manipulate objects with both hands during screening sessions. This was informally evaluated during the study. Ann was able to lift and release all of the objects used in the study.

Potential reinforcers suggested by the teachers for Ann were juice, a plastic bee, bells, and a large hand drum. A

fifth choice, a cracker and cheese, was also included in the reinforcer sample.

Ann looked at the reinforcers as they were offered to her. She chose the juice over any other potential reinforcer 100% of the time. Juice was used as the reinforcer for Ann throughout the study.

Hal was a boy of 6 years, 11 months with severe handicaps. He was able to sit upright in a chair, but was unable to stand independently. Hal was often sleepy, and would occasionally fall asleep while in a seated position. He had a seizure disorder that was being controlled with medication. Hal was able to pick up and release all of the objects used in the study but he had difficulty consistently grasping the toothbrush. He was predominantly right-handed. Hal communicated by smiling, laughing, and crying. He made several non-specific vocalizations.

A graham cracker, milk, a cracker with cheese, bells, and a hand drum were evaluated as reinforcers for Hal. He most frequently chose the drum (17/20 trials) or the bells (14/20 trials). The drum or the bells were given as reinforcers during the Baseline, and the Model-Test phases of the study. At that time, the researcher felt that they were not effective reinforcers because Hal began to either push them away or cry when they were taken from him. Juice replaced the bells and drum as reinforcers for Hal for the remainder of the study.



Alex was a boy of 5 years, 8 months with severe handicaps. He communicated with smiles and non-specific vocalizations. During lunch, he was able to choose a food item by pointing to one of three pictures. Alex was very attentive to movements of persons in the room. He was unable to walk and would thrust his shoulders forward when seated. He was able to pick up and release the objects used in the study. At times, he would push the object (such as the toothbrush) to the raised edge of the wheelchair tray before he picked it up. Alex was left-handed.

The potential reinforcers evaluated for Alex were cheese, chocolate pudding, juice, a cracker with cheese, and a plastic toy alligator. Alex most frequently chose pudding (14/20 trials) or juice (12/20 trials). Throughout the study, pudding and juice were given to Alex as reinforcers.

Oliver was a boy of 13 years, 5 months with severe handicaps. He could not stand without support, but he was able to shuffle along the floor using his hands and feet. He was also able to manipulate his wheelchair in the classroom and through doorways. When presented with the objects used in the study, he was able to lift and release all of them. Oliver could communicate by saying "Hi" to persons who had entered the room. He was also able to communicate his lunch preference by pointing to one of two pictures of food items.

Potential reinforcers for Oliver were chocolate pudding, juice, milk, orange pop, or a cracker with cheese. He most frequently chose chocolate pudding (14/20 trials) or

juice (13/20 trials). Throughout the study, chocolate pudding and juice were given to Oliver as reinforcers.

B. Experimental Design

The experimental design was a within-subject design with repeated measures of each subject's responses (Kazdin, 1982). The study was to have been a multiple-baseline across subjects study with a baseline, training and maintainance phase. However, student performance throughout the study prompted several changes in the experimental design. The experimental design used for this study was a revised AB design with a replication of the study across four subjects (see Figure 1).

BASELINE		TRAINING SESSIONS	
	MT	MP/MT	
*****	-----*	-----*-----*	Ann
*****	-----*	-----*-----*	Hal
*****	-----*	-----*-----*	Alex
*****	-----*	-----*-----*	Oliver

MT = Model-Test

MP/MT = Model-Test/Model-Prompt

- = Training task (Tasks 1-3) sessions

* = Generalization task (Tasks 4-12) probes

Figure 1: Experimental Design

Probes administered throughout the study assessed generalization of imitation by assessing whether behaviors

not specifically targeted for intervention had changed (Kazdin, 1982). Generalization probes evaluated student's generalization of performance from the three training tasks to tasks varying in materials and/or motor movements.

The baseline phase evaluated the ability of the subjects to imitate both the training and the generalization tasks. During the baseline period, three trials of each of the training tasks (Tasks 1-3) were assessed during the first and every alternate session. Generalization tasks were evaluated on the second and every alternate session. Generalization probe sessions consisted of one trial on each of nine generalization tasks (Tasks 4-12). Training and generalization tasks are described in the Appendix.

Baseline assessments were to have been conducted for each subject until the baseline data indicated a stable trend. Ideally, the baseline would have exhibited a consistent horizontal, downward, or upward trend. For example, a student would have performed each training task at the same performance level for each trial (horizontal trend), decreased the performance level score on successive trials (downward trend), or increased the performance level score on successive trials (upward trend). Training was to begin for each student as a consistent trend was established for all three training tasks. However, none of the students established consistent trends for all of the training tasks (Tasks 1-3). Performance varied for each student on each task as the Baseline continued. Because of the variability

in task performance between trained tasks during the Baseline, and because the repeated tests may have influenced performance (Kazdin, 1982), the training intervention for students began following the twelfth Baseline session.

Unfortunately, the change of experimental designs from a multiple-baseline across subjects to an AB design with a replication across subjects limits the conclusions that can be made regarding the results. The AB experimental design is not as reliable a test of causality as is the multiple-baseline experimental design because the results may have been confounded by three threats to internal validity - history, maturation, and testing (Kazdin, 1982).

The potential influence of history and maturation are partially accounted for by examining the results of the performance of four students with varying ages, residences, and instructional programs.

It is not possible to assess the influence of repeated testing on the performance of the four students. It is possible that student's performance changed as a result of the presentation of the same number of trials during the baseline. Even though the AB design has certain limitations, tentative conclusions regarding the results were made by examining the treatment effects across the four subjects.

During the training phase, the students were taught to imitate three tasks. Three trials of each training task (Tasks 1-3) were presented to the student during each training session. Generalization probe sessions were to have

occurred on the session directly following that in which students reached criterion on any of the three tasks to assess generalization of performance to untrained tasks. After each generalization probe, training sessions would have resumed until each task met criterion. When the third task had reached criterion, a generalization probe session would have been administered on the following session, and training would have been discontinued. Maintenance of trained and generalized tasks was to have been assessed once per week for two consecutive weeks following the last generalization probe session.

Two changes to the research design as outlined in the proposal were made. Prior to the commencement of the study, a decision was made to assess generalization of task performance at more frequent intervals throughout the study (rather than assessing generalization only when the students completely imitated each of the training tasks on 5/6 trials). Probes for generalization to Tasks 4-12 occurred on six Baseline sessions, one Model-Test session, and three Model-Prompt/Model-Test sessions.

In addition, a change in the instructional procedure used for training occurred after nine training sessions (in order to increase the number and quality of prompted responses). Thus, the two training phases are referred to as the Model-Test (MT) and Model-Prompt/Model-Test (MP/MT) phases.

The research literature provided little information regarding the complex instructional process used to teach imitative behavior to persons with severe handicaps. The methods used to determine when baseline data was considered stable and, thus, when to begin imitation training were not clearly outlined. Decisions regarding the instructional process and the method of scoring imitative performances for this study were made in response to the results of a pilot study with two students having severe handicaps who did not participate in this study. In addition, changes in the research design and the instructional process occurred during the study in response to an ongoing analysis of student performance.

Applied research requires an interactive process between experimental control and potential benefits for subjects to be derived from the study. Modifications made during the study resulted in a less definitive evaluation of one instructional procedure (the Model-Test instructional procedure), but provided information about an altered instructional procedure (the Model-Prompt/Model-Test instructional procedure) that appeared to be of greater value for the students.

C. Procedure

Following a baseline assessment, subjects were taught to imitate the model of three dissimilar tasks (Tasks 1-3). Periodic probes of generalization tasks (Tasks 4-12)

assessed generalization of performance to untrained tasks.

The training and generalization tasks were defined as similar or dissimilar on the basis of topographical characteristics (differences or similarities in the motor movements required to perform the task) and differences or similarities in the materials used. The difficulties in defining tasks as similar or dissimilar were evident from the results of a pilot study completed by the researcher.

Eight teachers experienced in teaching students with severe handicaps were asked to evaluate 21 pairs of tasks on their relative difficulty of performance for learners with severe handicaps and on the similarity of the motor movements the tasks required.

The teachers were to decide if Task A was much harder than, harder than, equal to, easier than, or much easier than Task B. On only 1/21 pairs did all eight teachers agree that one of the tasks was easier or much easier in relation to the other task. On 14/21 pairs of tasks, some teachers scored one task as being harder than the other, while some teachers scored the same task as being easier than the other.

The teachers were also asked to decide if Task A was very similar to, similar to, the same as, different from, or very different from Task B for all 21 pairs of tasks. On only 2/21 pairs of tasks did all eight teachers agree that one of the tasks was either different or very different than the other task with regard to the motor movements used in

the tasks. On 21/21 pairs of tasks some teachers scored one task as being similar to the other, while some teachers scored the same task as being different from the other.

The tasks used for this study were chosen because of their potential functional uses for the students. Similar and dissimilar tasks were determined by performing the tasks and observing the students' manipulations of similar materials.

Three dissimilar tasks (Tasks 1-3) were chosen as training tasks. These tasks, briefly discussed below, are discussed in detail in the Appendix. Task 1 required the students to lift and place a toothbrush into a jar. Task 2 required the students to remove a lid from a pan and place it onto the table. Task 3 required the students to remove a spoon from a silverware tray and place it beside the tray on the table.

During each training session, each of the three training tasks was modelled three times in a concurrent trial sequence procedure. Concurrent trial sequencing has been shown to be more effective than serial trial sequencing for promoting generalization (Panyan et al., 1978; Schroeder et al., 1972). The tasks were presented in a random sequence determined prior to each session.

The students were instructed using a procedure for teaching imitation similar to that suggested by York et al. (1976). The instructor prompted the student to attend to the placement of the materials by saying "Ready" before placing

the materials on the table. Once the student attended to the materials, the instructor said, "Do this", and modelled the task. The materials were then returned to the initial position as they were prior to the model of the task. For example, if the materials were altered by modelling a pouring task, the student was given the materials as they were before the material was poured.

Following the model of the task, the students were physically prompted to perform the task. As the student began to independently perform the task, physical prompting was faded by reducing the amount of touch, reducing the pressure of the touch, and/or moving the prompt away from the body part performing the task (Foxx, 1982). The students were reinforced for successive approximations of the task.

Students were taught to perform the training tasks (Tasks 1-3) for nine training sessions of the Model-Test phase. At that time, it became apparent that the outlined instructional procedure allowed the students to make no response for the 10 second response time, or to begin to manipulate the materials inappropriately before the instructor prompted the correct completion of the task. For example, Ann began to push the pan from the table during Task 2 trials before the instructor could intervene with an appropriate prompt. The instructional procedure that occurred for Ann during the initial Model-Test phase on Task 2 was as follows: The instructor had Ann attend to the materials, gave the task command, "Do this", and modelled

the removal of the lid. The lid was then replaced as it was before the model. Ann was then given 10 seconds to imitate the model. The 10 second time delay allowed for either no response, or the initiation of an inappropriate response (such as pushing the pan away) before the instructor intervened.

The importance of teaching learners with severe handicaps using an errorless learning approach has been suggested by Baine (1982). Horner et al. (1982) also suggested that identifying errors performed by students and altering the instructional process to eliminate errors was necessary when teaching persons with severe handicaps.

To reduce the incidence of errors in task performance, the instructional procedure was changed so that the students received two models for each task rather than one. Following the first model of a task, the students were immediately prompted to complete the task and reinforced at the completion of the task. On the second model of the task, the students were allowed 10 seconds to imitate the task. If the students did not begin to perform the task during the 10 second interval, or if s/he began to manipulate the materials inappropriately, the instructor prompted the correct performance of the task. The students were then reinforced only if they had more closely approximated the performance of the modelled task than in prior unprompted trials. Student performance was scored only on the second trial of each modelled task.

During the modified instructional phase (the MP/MT phase) the instructor gave an additional task command to signal the students to begin their replication of the modelled task. As in the MT phase, the instructor gave the task command, "Do this", prior to the model of each task. During the MP/MT phase, she also gave the task command, "Do it", after the materials had been restored to their pre-modelled state. This additional task command was given so as to make clearer the distinction between watching the model (following "Do this") and imitating the model (following "Do it"). In the Model-Test phase the task command, "Do it", was not used to cue the students to begin to move the materials.

The changes in the instructional procedure for the Model-Prompt/Model-Test (MP/MT) phase permitted the instructor to intervene, if required, to ensure that the student began to perform each training task within 10 seconds following the "Do it" command, and to prompt the learner to avoid response errors. The students also received an additional cue ("Do it") to begin his or her model of the task. Because of the introduction of the model-prompt-reinforce instruction, the students received reinforcement following the first prompted completion of each modelled task. They also received reinforcement if they more closely approximated the second model of the task. During the Model-Test phase, the students received reinforcement only if they more closely approximated the

model of the task. Thus, an improved instructional format was used during the MP/MT training sessions that intervened before errors were committed, gave more precise signals for either watching the model or beginning performance of a task, and increased reinforcement for completed tasks.

Imitation training of the three dissimilar tasks was to have continued until task criterion was reached for each task. Task criterion was defined as an imitation of the task following the task command, and the model of the task on a total of five of six trial presentations on two consecutive sessions. Since no student achieved the criterion for any training task (Tasks 1-3), imitation training continued until the completion of the study.

Generalization of imitation was assessed by evaluating each student's ability to imitate a model of tasks s/he had not been directly trained to imitate. Generalization tasks were defined based on their similarities to the three training tasks (Tasks 1-3). The generalization tasks included three tasks (Tasks 4-6) with materials and topography similar to the trained tasks (Tasks 1-3), three tasks (Tasks 7-9) with different materials but having topography similar to the trained tasks (Tasks 1-3), and three tasks (Tasks 10-12) varying from the trained tasks (Tasks 1-3) in both topography and materials.

Three generalization tasks (Tasks 4-6) had materials and motor movements similar to the three training tasks (Tasks 1-3). Each pair of tasks (1 and 4; 2 and 5; 3 and 6)

used similar materials and motor movements (see the Appendix for a detailed description of the materials, the material placement before the model, the model of the task, and the performance level scores used for each task).

Tasks 1 and 4 required the students to place a toothbrush into a jar (Task 1) or a can (Task 4). Tasks 2 and 5 required the students to remove a lid from a large pan (Task 2) or a small pan (Task 5) and place it on the table. Tasks 3 and 6 required the students to remove a spoon from a silverware tray (Task 3) or a hairbrush from an open container (Task 6) and place them on the table. /

Three generalization tasks (Tasks 7-9) used motor movements similar to those of the training tasks, but had materials that differed from the training tasks (Tasks 1-3). Each pair of tasks (1 and 7; 2 and 8; 3 and 9) used similar motor movements but different materials.

Tasks 1 and 7 required the students to place a toothbrush into a jar (Task 1) or place a spoon into a dishwasher utensil holder (Task 7). Tasks 2 and 5 required the students to remove a large pan lid (Task 2) or a thermos lid (Task 8) and place it on the table. Tasks 3 and 9 required the students to remove a spoon from a silverware tray (Task 3) or a box of apple juice from a lunchkit (Task 9) and place them on the table.

Generalization tasks 10, 11, and 12 varied from the training tasks (Tasks 1-3) and from each other in both the motor movements used to perform the tasks and in the

materials used in each task. Task 10 required the students to place one identical bowl within another. Task 11 required that the students pour cereal into a bowl. Task 12 required the students to place a slice of bread into a toaster.

At various points throughout the study, each generalization task was modelled once in a predetermined random sequence. During the Baseline and MT phases, generalization of the imitative response was considered to have occurred if the student imitated the generalization task following the task command, "Do this", and the model. During the MP/MT phase, generalization of the imitative response occurred if the student imitated the generalization task following the task command, "Do this", the model, and the task command, "Do it". The students were reinforced for every third trial on a variable ratio schedule during generalization probe sessions.

D. Evaluation

Interobserver and procedural reliability were assessed during four Baseline and five Model-Prompt/Model-Test sessions. The interobserver (a certified teacher) received three hours of instruction on the instructional procedure (placement of materials, model of the task, task commands, and reinforcement of the students) and the scoring procedure prior to assessing the students' and the instructor's performance. The sessions were assessed by viewing the students and instructor through a two-way mirror.

Interobserver reliability of the scoring of student performance was computed by dividing the number of agreements by agreements plus disagreements. Procedural reliability assessments determined whether the outlined instructional procedure was followed during the study. This included an assessment of the material placement, the model, task commands, response time, and reinforcement procedures. Procedural reliability was computed by dividing the number of tasks during which the procedure was completed correctly by the total number of tasks modelled.

Data was gathered by the instructor on each student's performance on each trial during Baseline and MT sessions. During MP/MT sessions, the instructor recorded each student's performance on the second trial for each task. (The first trial, during MP/MT sessions, was prompted immediately after the model.)

Initially, each trial was to have been recorded simply as an acceptable or unacceptable imitation of the modelled task as defined by behavioral objectives. The behavioral objectives described the conditions, behavioral response and the criterion for each task. The criterion included the response latency, topography of the behavior and the acceptable result of the behavior.

However, after interacting with and observing the students prior to the study, it became apparent that a more detailed evaluation of imitative behavior was required. Rather than evaluate the performance of a task in its

entirety as being an acceptable or unacceptable imitation of the model, performance on each task was defined in terms of five qualitatively different levels of imitation. A numerical score was assigned to each level of performance (see the Appendix for a description of the performance levels of imitation for each task).

Although the performance level objectives varied somewhat for each task, the same criteria were used for the scoring of each task. The students were given a 10 second response time to perform each task following the model and task command. The students received a performance level score (levels 1-5) that described his or her level of imitation prior to an error being made or the response time elapsing.

Students received a performance level score of 0 if they did not touch the relevant part of the materials during the response time or if they first touched an irrelevant part of the materials. For example, on Task 1 (where the students were to lift a toothbrush from the table into a jar), if students did not touch the toothbrush or touched the jar instead of the toothbrush within 10 seconds of the task command they received a performance level score of 0.

Performance level scores of 1 were awarded if the students touched the relevant part of the materials. For example, on Task 1, students received a performance level score of 1 for touching any part of the toothbrush.

Students received a performance level score of 2 if they lifted or moved the relevant part of the materials. For example, students received a performance level score of 2 on Task 1 if they lifted the toothbrush by its handle off the table.

Performance level scores of 3 were awarded if the students placed the materials in the correct position. For example, a performance level score of 3 on Task 1 required the students to place the bristled-end of the toothbrush inside the opening of the jar.

A performance level score of 4 was awarded if the students completed the task. For example, students received a performance level score of 4 on Task 1 if they had placed the toothbrush into the jar within 10 seconds of the task command.

Performance on training and generalization tasks was evaluated following the Baseline, Model-Test, and Model-Prompt/Model-Test phases. The percent of trials at each performance level during each phase were compared for each student. Evaluation of student errors were made from brief descriptions of task performance that were made following the scoring of each task.

V. RESULTS

A. Interobserver Reliability

The average interobserver reliability for student performance scores during Baseline sessions for training tasks (Tasks 1-3) was 97%, and 89% for generalization tasks (Tasks 4-12) (see Table 1 for Interobserver Reliability results). Average reliability scores varied between students from 94% to 100% for Baseline training tasks, and from 67% to 100% for Baseline generalization scores. Oliver (reliability score of 67%) was evaluated during only one Baseline session for generalization task imitation. All other interobserver reliability scores for Oliver were 100% in agreement.

STUDENT	BASELINE		MODEL-PROMPT/MODEL-TEST (MP/MT)	
	Training Tasks	Generalization Tasks	Training Tasks	Generalization Tasks
Ann	100%	94%	94%	89%
Hal	94%	94%	93%	100%
Alex	94%	100%	92%	100%
Oliver	100%	*67%	100%	100%

*Only one session was assessed

Table 1: Interobserver Reliability

The average reliability during MP/MT sessions was 95% for training tasks, and 97% for generalization tasks. Average reliability scores varied between students from 92% to 100% for Model-Prompt/Model-Test (MP/MT) phase training

tasks, and from 89% to 100% for MP/MT generalization tasks.

Procedural reliability was 96%. The following errors in procedure occurred: incorrect placement of materials (.3%), incorrect model of the task (.6%), incorrect command (.3%), and not allowing the full 10 second response time (3%). All instances of not allowing the full 10 second response time occurred during one session. The student was performing very poorly (falling asleep between trials) while his mother watched the session.

B. Acquisition

Hypothesis I (Tasks 1 - 3) - Students with severe handicaps will improve performance of tasks varying in materials and motor movements when prompted to imitate a model of the task.

No student was able to imitate completely (obtain a performance level score of 4) any of the trained tasks to the criterion specified for each task. Task criterion was achieved when the students performed an exact imitation of the modelled task following the task command and model on a total of five of six trial presentations in two consecutive sessions. Since task criterion was never met, the training of Tasks 1-3, and the evaluation of the generalization tasks (Tasks 4-12) continued to the completion of the study. If task criterion had been met for any of the trained tasks, instruction would have continued only for the tasks that did not meet task criterion, and the learned tasks would have

been periodically assessed for maintainance.

Even though no student met criterion for any of the training tasks, each student did exhibit an improvement in imitation on a minimum of 2/3 training tasks (see Figure 2). The students improved performance on a total of 10/12 training tasks. Improvements in imitation for each student were assessed by comparing Baseline task performance level scores with scores obtained in the Model-Test (MT) and Model-Prompt/Model-Test (MP/MT) phases.

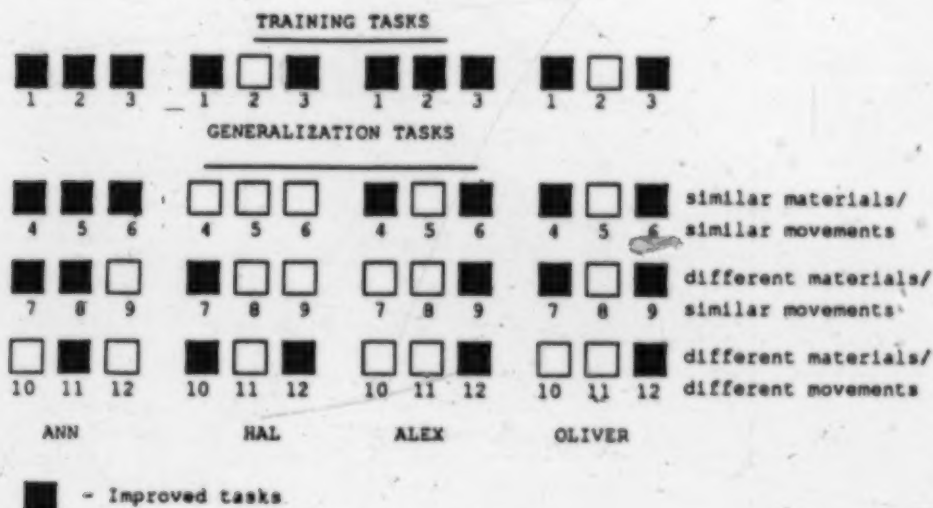


Figure 2: Task Performance (Tasks 1-12)

The results for the acquisition of Tasks 1-12 are presented in Tables 2-5. The percent of trials scored at each performance level for the Baseline, Model-Test (MT), and the Model-Prompt/Model-Test (MP/MT) phases are given for each student.

BASELINE					MT TRAINING					MP/MT TRAINING							
TASK	PERFORMANCE LEVEL				TASK	PERFORMANCE LEVEL				TASK	PERFORMANCE LEVEL						
	0	1	2	3	4		0	1	2	3	4		0	1	2	3	4
1	22%	6%	72%	-	-	1	22%	22%	56%	-	-	*1	9%	11%	80%	-	-
4	33%	17%	50%	-	-	*4	-	-	+	-	-	*4	-	-	100%	-	-
7	33%	-	67%	-	-	*7	-	-	+	-	-	*7	-	-	100%	-	-
2	72%	28%	-	-	-	*2	26%	45%	22%	7%	-	*2	4%	22%	50%	7%	17%
5	50%	33%	-	-	17%	5	+	-	-	-	-	*5	-	-	33%	-	67%
8	83%	17%	-	-	-	*8	-	-	+	-	-	*8	33%	-	67%	-	-
3	61%	22%	17%	-	-	*3	11%	19%	59%	4%	7%	*3	11%	4%	76%	0%	9%
6	33%	33%	17%	-	17%	6	-	-	+	-	-	*6	-	-	33%	33%	33%
9	-	-	33%	-	67%	9	-	+	-	-	-	9	-	-	67%	-	33%
10	17%	50%	17%	17%	-	10	-	-	-	+	-	10	-	67%	33%	-	-
11	67%	33%	-	-	-	11	+	-	-	-	-	*11	33%	67%	-	-	-
12	17%	33%	50%	-	-	12	+	-	-	-	-	12	67%	-	33%	-	-

Note: Generalization Tasks 4-12 in T1 consisted of 1 probe only (+ indicates the performance level score for the MT probe)

*Performance level scores improved when compared to the Baseline

Table 2: Percent of Trials at Each Performance Level:
Baseline, Model-Test (MT), & Model-Prompt/Model-Test (MP/MT)

Student: Ann

BASELINE					MT TRAINING					MP/MT TRAINING							
TASK	PERFORMANCE LEVEL				TASK	PERFORMANCE LEVEL				TASK	PERFORMANCE LEVEL						
	0	1	2	3	4		0	1	2	3	4		0	1	2	3	4
1	61%	-	-	28%	-	1	78%	7%	15%	-	-	*1	35%	32%	33%	-	-
4	83%	-	17%	-	-	4	+	-	-	-	-	4	100%	-	-	-	-
7	50%	33%	17%	-	-	*7	-	-	+	-	-	*7	-	-	100%	-	-
2	83%	17%	-	-	-	*2	74%	26%	-	-	-	2	94%	6%	-	-	-
5	50%	50%	-	-	-	*5	-	+	-	-	-	5	100%	-	-	-	-
8	100%	-	-	-	-	8	+	-	-	-	-	8	100%	-	-	-	-
3	100%	-	-	-	-	*3	93%	7%	-	-	-	*3	96%	4%	-	-	-
6	83%	17%	-	-	-	6	+	-	-	-	-	6	100%	-	-	-	-
9	67%	33%	-	-	-	9	+	-	-	-	-	9	100%	-	-	-	-
10	17%	66%	17%	-	-	10	+	-	-	-	-	*10	-	33%	67%	-	-
11	100%	-	-	-	-	11	+	-	-	-	-	11	100%	-	-	-	-
12	50%	-	50%	-	-	*12	-	-	+	-	-	*12	-	33%	67%	-	-

Note: Generalization Tests 4-12 in Table 1 are for the 12 tasks.

Note: Generalization Tasks 4-12 in T1 consisted of 1 probe only (+ indicates the performance level score for the MT probe)

*performance level scores improved when compared to the Baseline

Table 3: Percent of Trials at Each Performance Level:
Baseline, Model-Test (MT), & Model-Prompt/Model-Test (MP/MT)

Student: Hal

BASELINE					MT TRAINING					MP/MT TRAINING							
TASK	PERFORMANCE LEVEL				TASK	PERFORMANCE LEVEL				TASK	PERFORMANCE LEVEL						
	0	1	2	3	4		0	1	2	3	4		0	1	2	3	4
1	67%	5%	28%	-	-	1	78%	7%	15%	-	-	*1	41%	4%	53%	2%	-
4	50%	33%	17%	-	-	*4	-	-	+	-	-	*4	33%	-	67%	-	33%
7	-	-	83%	-	17%	7	-	-	+	-	-	*7	-	-	67%	-	-
2	39%	44%	17%	-	-	2	48%	4%	48%	-	-	2	54%	9%	37%	-	-
5	-	17%	83%	-	-	5	-	+	-	-	-	5	33%	33%	67%	-	-
8	33%	67%	-	-	-	*8	-	+	-	-	-	8	33%	67%	-	-	-
3	50%	-	50%	-	-	3	55%	4%	41%	-	-	*3	48%	13%	37%	-	2%
6	100%	-	-	-	-	6	+	-	-	-	-	*6	33%	-	67%	-	-
9	50%	33%	17%	-	-	9	+	-	-	-	-	*9	-	33%	33%	-	-
10	17%	33%	33%	17%	-	10	-	-	+	-	-	10	-	-	100%	-	-
11	33%	50%	17%	-	-	11	+	-	-	-	-	11	33%	67%	-	-	-
12	67%	-	33%	-	-	12	+	-	-	-	-	*12	33%	-	67%	-	-

Note: Generalization Tasks 4-12 in T1 consisted of 1 probe only (+ indicates the performance level score for the MT probe)

*performance level scores improved when compared to Baseline

Table 4: Percent of Trials at Each Performance Level:
Baseline, Model-Test (MT), & Model-Prompt/Model-Test (MP/MT)

Student: Alex

BASELINE					MT TRAINING					MP/MT TRAINING							
TASK	PERFORMANCE LEVEL					TASK	PERFORMANCE LEVEL					TASK	PERFORMANCE LEVEL				
	0	1	2	3	4		0	1	2	3	4		0	1	2	3	4
1	67%	5%	28%	-	-	*1	52%	15%	33%	-	-	*1	15%	31%	54%	-	-
4	83%	17%	-	-	-	*4	-	-	+	-	-	*4	33%	33%	33%	-	-
7	17%	17%	67%	-	-	7	+	-	-	-	-	7	33%	67%	-	-	-
2	28%	50%	22%	-	-	*2	26%	33%	37%	-	4%	*2	17%	22%	59%	-	2%
5	17%	33%	50%	-	-	5	+	-	-	-	-	5	-	67%	33%	-	-
8	-	33%	50%	-	17%	8	-	+	-	-	-	8	33%	33%	33%	-	-
3	78%	22%	-	-	-	*3	59%	33%	8%	-	-	*3	58%	33%	8%	-	-
6	33%	67%	-	-	-	*6	-	+	-	-	-	*6	-	100%	-	-	-
9	17%	67%	17%	-	-	9	+	-	-	-	-	*9	-	67%	33%	-	-
10	-	-	100%	-	-	10	-	-	+	-	-	10	-	-	100%	-	-
11	33%	67%	-	-	-	*11	-	+	-	-	-	*11	33%	67%	-	-	-
12	50%	-	50%	-	-	*12	-	-	+	-	-	*12	-	-	100%	-	-

Note: Generalization Tasks 4-12 in T1 consisted of 1 probe only (+ indicates the performance level score for the MT probe)

*performance level scores improved when compared to the Baseline

Table 5: Percent of Trials at Each Performance Level:
Baseline, Model-Test (MT), & Model-Prompt/Model-Test (MP/MT)

Student: Oliver

Tasks 1, 4, and 7; 2, 5, and 8; and 3, 6, and 9 are grouped together based on the similar motor movements required to perform each group of tasks. For example, Tasks 1, 4, and 7 required the student to move either a toothbrush or a spoon into a container. Tasks 10, 11, and 12 varied from each other and from Tasks 1-9 in both materials and motor movements. A star precedes the task number in the MT and MP/MT results if the student improved their performance of that task.

To evaluate improvements in performance of training tasks (Tasks 1-3), the percent of trials scored at each performance level during the Baseline, MT, and MP/MT phases were compared. Improvements in performance of generalization tasks were evaluated by comparing the percent of probes scored at each performance level during the Baseline, and MP/MT. (The MT phase had only one generalization probe so these results were not represented as a percentage score.) If performance level scores varied between the Model-Test and Model-Prompt/Model-Test phases, these results were discussed in the results. If there was no variation in MT and MP/MT scores the results were discussed for MP/MT only.

Improved imitation was considered to have occurred if a student met two performance criteria. First, a student had to decrease the percent of trials that s/he scored at performance level 0. A performance level score of 0 was given if the student did not begin to imitate any part of the task within 10 seconds of the model and task command.

Secondly, a student had to increase the percent of trials at the highest level achieved during Baseline or begin to imitate at higher than Baseline levels of performance in the MP/MT phase. For example, Ann's results on Task 1 (see Table 2) show a decrease in the percent of trials scored at performance level 0 from 22% in Baseline to 9% in MP/MT. She also increased the percent of trials scored at performance level 2 from 72% in the Baseline to 80% in MP/MT. Therefore, she met both performance criteria required to demonstrate an improvement in imitation.

Ann also improved her imitation of Task 2 (see Table 2). She decreased the percent of performance level 0 scores from 72% to 4% (the first performance criteria), and increased the percent of trials scored at performance levels 2, 3, and 4 (the second performance criteria) during MP/MT.

There were three instances in which students did not exhibit an improvement in imitation. First, if a student increased the percent of trials scored at performance level 0 during MP/MT, they were not considered to have improved imitation. For example, Hal (see Table 3, Task 2) increased the percent of performance level scores of 0 for Task 2 from 83% during the Baseline to 94% during MP/MT. He did not meet the first performance criteria for improved imitation.

Second, a student was not considered to have improved imitation if they decreased the percent of trials scored at the highest Baseline performance level. For example, for Ann (see Table 2, Task 10), the percent of probes scored at

performance level 3, on Task 10 decreased from 17% during the Baseline to 0% in MP/MT. Performance level 3 was the highest Baseline performance level for Task 10. Since this was a decrease in the percent of trials at the highest Baseline performance level rather than an increase, the second performance criteria for improved imitation was not met.

Third, students were not considered to have improved their imitation if there were no changes in the percent of trials scored at any performance level. For example, Alex (see Table 4, Task 10) scored 100% of probes at performance level 2 for Task 10 during the Baseline and MP/MT. He did not meet the second performance criteria for improved imitation.

Two of four students, Ann and Alex, improved performance of all three training tasks (Tasks 1, 2, and 3). Two students, Hal and Oliver, improved performance of Tasks 1 and 3, but did not improve performance of Task 2.

Task 1 - Imitation of Task 1 required the students to place a toothbrush into a jar so that the bristled end of the toothbrush was at the bottom of the jar. The toothbrush was placed in front of the student's dominant hand with the handle facing the student.

The students received a performance level score of 1 if they touched the toothbrush, 2 if they picked up the toothbrush, 3 if they placed the toothbrush into the jar, and 4 if they released the toothbrush into the jar. If the student did not touch the toothbrush within 10 seconds of

the task command, they received a performance level score of 0. (See the Appendix for a detailed description of the materials, the presentation, the model of the task, and the scoring procedure used for each task.)

During the Model-Prompt/Model-Test (MP/MT) phase, all four students improved their performance of Task 1 (see Tables 2-5) by decreasing the percent of trials at performance level 0, and increasing the percent of trials at or above the highest Baseline performance level score during MP/MT. Ann (see Table 2, Task 1) increased performance level 2 scores from 72% to 80%. Hal (see Table 3, Task 1) increased performance level 2 scores from 28% to 33%. Alex (see Table 4, Task 1) increased performance level 2 scores from 28% to 54%, and Oliver (see Table 5, Task 1) increased performance level 3 scores from 0% to 2%.

All four students reduced the percent of trials scored at performance level 0 during MP/MT when compared to Baseline percents. Ann (see Table 2, Task 1) reduced the percent of trials at performance level 0 from 22% to 9%, Hal (see Table 3, Task 1) from 61% to 35%, Alex (see Table 4, Task 1) from 67% to 15%, and Oliver (see Table 5, Task 1) from 67% to 41%.

During MT, however, Ann, Hal, and Oliver had either maintained or increased the percent of trials scored at performance level 0. Imitation improved for these students on Task 1 during MP/MT when they received additional modelling and prompting during instruction.

Oliver (see Table 5, Task 1) was the only student to receive a performance level score as high as 3 for Task 1. The other students received performance level scores of 2 as their highest score. Although the students were able to lift the toothbrush, they were not able to place it into the jar.

Ann and Alex began more frequently to lift and drop the toothbrush onto the table during MP/MT as the model had dropped it into the jar. Ann also began to place the toothbrush closer to or touching the jar during MP/MT. These behaviors suggest that Ann and Alex were more closely imitating the model of Task 1 during MP/MT without being able to place the toothbrush into the jar.

During the Baseline the most prevalent error for each student was to push or touch the jar rather than the toothbrush. Oliver was the only student to continue this error during the MT and MP/MT phases. Ann, Hal, and Alex reduced the occurrence of this behavior during the MT and MP/MT phases.

Task 2 - Imitation of Task 2 required the students to lift the lid from a cooking pan and place it anywhere on the table so that the handle of the lid faced upward. The pan was placed in front of the student so that the long handle on the side of the pan faced away from the student. (See the Appendix for a detailed description of the tasks.)

Students received a performance level score of 1 if they touched the handle of the lid, 2 if they lifted the lid off of the pan, 3 if they placed the lid right-side up on

the table, and 4 if they released the handle. A performance level score of 0 was awarded if a student did not touch the handle of the lid within 10 seconds of the task command.

Two of four students improved performance of Task 2 when MP/MT performance scores were compared to Baseline scores. Ann improved performance of Task 2 by decreasing the percent of trials scored at performance level 0, and increasing the percent of trials scored at performance levels 2, 3, and 4 during MT and MP/MT. Alex improved performance of Task 2 by decreasing the percent of trials scored at performance level 0, and increasing the percent of trials scored at performance levels 2 and 4 during MT and MP/MT.

Ann (see Table 2, Task 2) increased performance level scores of 4 from 0% during the Baseline to 17% during MP/MT. Alex (see Table 4, Task 2) increased performance level scores of 4 from 0% to 2%, and performance level scores of 2 from 22% to 59% when comparing Baseline and MP/MT scores.

Hal and Oliver did not improve their performances of Task 2. Both students increased their percent of trials at performance level 0 during MP/MT. Hal (see Table 3, Task 2) increased performance level scores of 0 from 83% during the Baseline to 94% during MP/MT. Oliver (see Table 5, Task 2) increased his performance level scores of 0 from 39% during the Baseline to 54% during the Baseline.

The most prevalent errors differed between the students. Hal had most often touched the lid in the Baseline

and MT, but he stopped touching the materials in MP/MT. Oliver began to push the materials off the table more often in MP/MT. Alex began to lift and transfer the lid without placing it on the table in MP/MT.

Ann (see Table 2, Task 2) displayed a progressive improvement in the level of imitative performance on Task 2 in successive phases of the study. She initially pushed the pan away (performance level 0) during the Baseline on 72% of trials, then touched the handle of the lid (performance level 1) on the most trials (45%) during MT. During the MP/MT phase, she lifted the lid on 50% of trials (performance level 2) and began to complete the task (performance level 4) on 17% of trials. A learning progression such as this was not demonstrated by Ann on any other task nor by any other student on any task.

When students began to imitate the tasks at higher levels of performance, they usually included a variety of performance level responses during each session. Learning to imitate the tasks did not follow a progressive improvement over successive trials. For example, students did not begin to touch the handle, then lift it, then set it down on progressive trials. Instead, they might have pushed the pan away on the first trial, lifted the lid on the second trial, and touched the lid on the third trial - all within one training session. Even when students demonstrated that they were capable of imitating the task at higher performance levels, they did not consistently perform the tasks at the

highest level of performance they had previously demonstrated.

Task 3 - Imitation of Task 3 required the students to lift a spoon from the first compartment of a silverware tray and place it onto the table. The spoon had to be placed to the side of the silverware tray (to the right for right-handed students, and to the left for the left-handed students) so that the handle faced the student. (See the Appendix for a detailed description of the tasks.)

The students received a performance level score of 1 if they touched the spoon, 2 if they lifted the spoon by the handle, 3 if they placed the spoon on the table at the side of the tray, and 4 if they released the spoon. A performance level score of 0 was given if the students did not touch the spoon within 10 seconds of the task command.

All four students improved their performance of Task 3 when MP/MT scores were compared to Baseline level scores. However, there were substantial variations in each student's performance level scores.

Hal (see Table 3, Task 3) demonstrated a very slight improvement in level 1 performance scores during MT and MP/MT from 0% during the Baseline, 7% during MT, and 4% during MP/MT. During Baseline, Hal most often slapped or touched the tray without touching the spoon. In MP/MT, he stopped making any movement towards the tray. This lack of movement towards the materials was also evident for Task 2 on MP/MT trials. Hal had very little success imitating

either Task 2 or 3, and eventually stopped touching the materials or moving towards them. This was not true for Task 1 where he continued to manipulate the materials and improve his imitations throughout the study.

Alex (see Table 4, Task 3) increased the percent of trials at performance levels 1 and 2 during MT from 22% to 33%, and 0% to 8%, respectively. The percent of trials for performance levels 1 and 2 were maintained from MT to MP/MT. His performance on Task 3 varied throughout the study. During each phase he scored performance level 0 on at least seven consecutive trials, after which he would perform Task 3 at performance levels 1 or 2. Alex's most frequent error on Task 3 did not vary between the phases. He most often pushed or lifted the tray rather than touch the spoon.

Ann (see Table 2, Task 3) greatly improved her performance of Task 3 during MT and MP/MT. The percent of trials scored at performance level 0 was reduced from 61% during the Baseline to 11% during MT and MP/MT. During MT, she began to lift the spoon (performance level 2) more frequently (from 17% of Baseline trials to 59% of MT trials) and completely imitated the task (performance level 4) on 7% of trials. She continued to improve the number of trials scored at performance level 2 during MP/MT (to 76%) and to improve slightly the percent of trials at performance level 4 (to 9%). However, 22% of MP/MT trials were scored performance level 2 rather than performance level 4 because Ann had placed the spoon in an incorrect position on the

table.

Oliver (see Table 5, Task 3) improved his performance of Task 3 by decreasing the percent of 0 performance level scores from 50% to 48%, and increasing the percent of performance level scores of 4 from 0% to 2% in MP/MT. However, he decreased the percent of trials scored at performance level 2 during MP/MT from 50% to 37% and increased the percent of trials scored at performance level 1 during MP/MT from 0% to 13%. Oliver began to push the tray away on Trial 8 of the Baseline, and he continued this behavior at a high rate throughout the study. He also began to throw the spoon off of his tray during MP/MT. Although he met the criteria for assessing change, the amount of change did not appear to be significant.

Students' most prevalent error on Task 3 was to push or touch the tray. Alex continued to push or touch the tray throughout the study. Hal did not touch or move the materials during MT and MP/MT. Oliver most often pushed the tray or threw the spoon during MP/MT. Ann's most frequent errors changed during the Baseline, MT, and MP/MT.

Two students completely imitated Task 3 during the study. Ann imitated Task 3 at performance level 4 on 7% of trials during MT, and 9% of trials during MP/MT. Oliver completely imitated the task during 2% of the trials in MP/MT.

C. Generalization

Hypothesis IIa (Tasks 4-6) - Students with severe handicaps will generalize a learned imitative response to tasks they have not been directly taught to imitate. These tasks (Tasks 4-6) used materials and motor movements similar to the initially trained tasks (Tasks 1-3). Tasks 1 and 4, 2 and 5, and 3 and 6 were similar to each other in both the materials used and in the motor movements required to perform the tasks.

The students improved their performance on a total of 7/12 generalization tasks with similar materials and motor movements as the training tasks (see Figure 2). One student, Ann, improved her performance on Tasks 4, 5, and 6. Two students, Alex and Oliver, improved their performance on Tasks 4 and 6, but not Task 5. Hal did not improve his performance of Task 4, 5, or 6.

Task 4 - Task 4 used materials and motor movements that were similar to Task 1. Imitation of Task 4 required the students to lift a toothbrush into a can so that the bristled end of the toothbrush was at the bottom of the can. Task 1 required the students to lift the same toothbrush in the same manner into a jar. The materials were placed in exactly the same positions for both Tasks 1 and 4 (see the Appendix for a detailed description of the tasks).

The same method of scoring was used for Tasks 1 and 4. The students received a performance level score of 1 if they touched the toothbrush, 2 if they picked up the toothbrush,

3 if they placed the toothbrush into the can, and 4 if they released the toothbrush into the can. If the students did not touch the toothbrush within 10 seconds of the task command, they received a performance level score of 0.

Three students improved their performance of Task 4 during the MP/MT phase when compared to Baseline performances. No student scored above performance level 2 on any probe throughout the study. Ann, Alex, and Oliver improved their performance by decreasing the percent of probes scored at performance level 0, and increasing the percent of probes scored at performance level 2. Hal did not improve his performance of Task 4.

Ann (see Table 2, Task 4) scored performance level 2 on 100% of probes in the MT and MP/MT phases. She had scored performance level 2 on 50% of the probes in the Baseline. During the Baseline, she would push away or touch, but not lift the toothbrush. In MT and MP/MT, she always lifted the toothbrush and would drop it to the table as she had done while performing Task 1.

Alex (see Table 4, Task 4) scored only performance levels 0 and 1 in the Baseline, but he scored performance level 2 on the MT probe, and on 33% of MP/MT probes. During the Baseline, he would touch the can as he had touched the jar for Task 1. In MT and MP/MT he most frequently touched the toothbrush for Task 1, and lifted or touched the toothbrush for Task 4.

Oliver (see Table 5, Task 4) increased the percent of probes scored at performance level 2 from 17% in the Baseline to 67% in MP/MT. He also scored performance level 2 on the MT probe. Following the Baseline, Oliver no longer scored performance level 1. He came very close to completing Task 4 during the last two MP/MT probes when he placed the toothbrush behind or on top of the can. There was no relationship between Oliver's errors on Tasks 1 and 4.

Hal (see Table 3, Task 4) did not improve his imitation of Task 4. He increased the percent of performance level 0 scores from 83% in the Baseline to 100% in MP/MT. He also scored performance level 0 in MT. Hal touched the can on every probe but one during the study. This error was similar to an error made on Task 1 during the Baseline and MT. Even though Hal reduced the number of times he touched the jar on Task 1 in MP/MT, he continued to touch the can for Task 4 until the completion of the study. He had not generalized his imitation of Task 1 to Task 4.

There appears to be similarities between two students' performance on Tasks 1 and 4. Ann and Alex had similar errors in performance for Tasks 1 and 4. Changes in errors on Task 1 following the Baseline were replicated in errors for Task 4 following the Baseline. Hal continued his errors on Task 4 without any correspondence to changes in errors on Task 1. Oliver also had different errors for Tasks 1 and 4 in Baseline, MT, and MP/MT.

Task 5 - Task 5 used materials and motor movements that were similar to Task 2. Imitation of Task 2 required the students to remove a lid from a large pan and place it onto the table. Task 5 required the students to remove the lid from a small pan and place it onto the table (see the Appendix for a detailed description of the tasks).

The same method of scoring was used with Tasks 2 and 5. The students received a performance level score of 1 if they touched the handle of the lid, 2 if they lifted the lid by the handle, 3 if they placed the lid upright on the table, and 4 if they released the handle. They received a performance level score of 0 if they did not touch the handle of the lid within 10 seconds of the task command.

Ann (see Table 2, Task 5) was the only student to improve imitation of Task 5. She increased performance level scores of 4 from 17% during the Baseline to 67% in MP/MT. As she had for Task 4, Ann eliminated responses at performance levels 0 and 1 in MP/MT for Task 5. During the Baseline, she most frequently pushed the pan away, but in MP/MT she most often completed the task. Ann's improvement in performance of Task 5 at performance level 4 corresponded with her improved performance on Task 2 at performance level 4.

Alex (see Table 4, Task 5) and Oliver (see Table 5, Task 5) decreased level 2 performance scores and increased level 1 performance scores in MP/MT on Task 5. Alex scored performance level 2 on 50% of probes during the Baseline, and 33% during MP/MT, but he eliminated all performance

level scores of 0 in MP/MT. Oliver scored performance level 2 on 83% of probes during the Baseline, and 67% during MP/MT. Even though both students lifted the lid more often for Task 2 in MP/MT, they decreased the percent of trials that they lifted the smaller lid for Task 5 during MP/MT. There was little relationship between the errors committed for Tasks 2 and 5 by Oliver despite the similarities in materials. Alex lifted and transferred the lids of Tasks 2 and 5 during MP/MT.

There did not appear to be a relationship between Oliver's errors in performance for Tasks 2 and 5. Alex, however, had similar lifting and transferring errors for Tasks 2 and 5 during MP/MT only. Alex improved his performance of Task 2 while Oliver did not improve his performance of either Task 2 or 5.

Hal's performance of Task 5 did not improve (see Table 3). He increased performance level scores of 0 from 50% in the Baseline to 100% in MP/MT. On Task 5, during the Baseline and MT, Hal most often touched the handle of the lid but on Task 2 he most often touched the lid without touching the handle. Although it appeared easier for Hal to touch the handle of the smaller pan used in Task 5, he never touched the handle in MP/MT. This also occurred for Task 2 in MP/MT.

Ann and Hal had similar errors for Tasks 2 and 5. Ann improved her performance of both tasks, while Hal did not improve performance of either task. Even though both Hal and

Oliver did not improve their imitation of either Task 2 or 5, Hal had similar errors on both tasks, but Oliver did not.

Task 6 - Task 6 used materials and motor movements that were similar to Task 3. Imitation of Task 3 required the students to remove a spoon from a silverware tray and set it onto the table. Task 6 required the students to remove a hairbrush from an open container and place it onto the table (see the Appendix for a detailed description of the tasks).

The same method of scoring was used for Tasks 3 and 6. The students received a performance level score of 1 if they touched the hairbrush, 2 if they lifted the hairbrush by the handle, 3 if they placed the hairbrush beside the container with the handle facing the student, and 4 if they released the hairbrush. A performance level score of 0 was given if the student did not touch the hairbrush within 10 seconds of the task command.

Three students improved their performance of Task 6 when Baseline performance was compared to MP/MT performance. Ann (see Table 2, Task 6) eliminated performance level scores of 0 and 1 during MT and MP/MT while increasing the percent of probes scored at performance levels 2, 3, and 4 to 33%. She had also eliminated performance level 0 scores for Tasks 4 and 5 during the MT and MP/MT phases. During the Baseline probes for imitation of Task 6, Ann would most often push the container away as she had done while performing Task 3. During MT and MP/MT probes, she most often lifted and dropped the spoon for Task 3 and the

hairbrush for Task 6.

Alex (see Table 4, Task 6) eliminated all performance level scores of 0 in the MT and MP/MT phases (from 33% during the Baseline), and improved his performance level 1 scores (from 67% during the Baseline to 100% during MP/MT). His most prevalent error for Task 6 was the same for the Baseline, MT, and MP/MT phases (touching the hairbrush or lifting it by the bristles). Alex lifted the container in Task 6 only during the Baseline, but he continued to lift the silverware tray in Task 3 throughout the study.

Oliver (see Table 5, Task 6) scored performance level 0 on every Baseline and MT probe, but he scored performance level 2 in MP/MT on 67% of probes. He had similar errors during the Baseline and MT phases for Tasks 3 and 6 (pushing or lifting the container). During MP/MT, Oliver lifted the container or threw the hairbrush off the table. These errors were also similar to the most frequent Task 3 errors during MP/MT.

Hal (see Table 3, Task 6) did not improve his imitation of Task 6. As for Tasks 4 and 5, he increased the percent of performance level 0 scores to 100% in MP/MT. His most prevalent error on Task 6 throughout the study was to push or touch the container. Although this error was similar to the most prevalent Task 3 error during the Baseline, the most prevalent Task 3 error in the MP/MT (not touching the materials) did not appear for Task 6. Hal continued to manipulate the materials for Task 6 in MP/MT, even after he

had stopped touching the materials for Task 3.

Ann and Oliver had similar errors for Tasks 3 and 6 in the Baseline (pushing the container), and similar errors in MP/MT (lifting and dropping the materials). Hal had similar errors for Tasks 3 and 6 in the Baseline (pushing or touching the container), but his errors differed in MT and MP/MT. Alex's errors were different for Tasks 3 and 6 throughout the study.

Hypothesis IIb (Tasks 7-9) - Students will generalize a learned imitative response to tasks they have not been directly taught to imitate when these tasks (Tasks 7-9) use motor movements similar to, but materials different from previously trained tasks (Tasks 1-3). Tasks 1 and 7, 2 and 8, and 3 and 9 were similar to each other in the motor movements required to perform the tasks, but they used different materials.

The students improved their performance on a total of 6/12 generalization tasks having similar motor movements, but different materials than the training tasks (see Figure 2). More of the training tasks (Tasks 1-3) and generalization tasks with similar materials and motor movements (Tasks 4-6) were imitated than generalization tasks with similar movements but different materials (Tasks 7-9).

No student improved performance of all three tasks with similar motor movements and different materials (Tasks 7-9) from the trained tasks (Tasks 1-3). Ann, Hal, and Oliver

improved performance of Task 7. Ann improved performance of Task 8. Alex and Oliver improved performance of Task 9.

Task 7 - Tasks 1 and 4 were similar to Task 7 in the motor movements required to move the materials. All three tasks required the students to lift an object (toothbrush or spoon) by the handle and place it into a container. The materials used for Task 7 were different from those used in Tasks 1 and 4 (see the Appendix for a detailed description of the tasks).

Imitation of Tasks 1 and 4 required the students to lift a toothbrush into a container. Task 7 required the students to place a spoon into a dishwasher utensil holder so that the bowl of the spoon faced downward.

The same method of scoring was used for Tasks 1, 4, and 7. On Task 7, students received a performance level score of 1 if they touched the spoon, 2 if they picked up the spoon, 3 if they placed any part of the bowl of the spoon within the utensil holder, and 4 if they released the spoon into the holder. They received a performance level score of 0 if they did not touch the spoon within 10 seconds of the task command.

Ann, Hal, and Oliver improved performance of Task 7 when MP/MT scores were compared to the Baseline scores. Oliver (see Table 5, Task 7) completed Task 7 during the MP/MT phase on 33% of probes (performance level score of 4). During the Baseline and MP/MT phases, he performed Task 7 better than he performed any other task. Oliver completed

the task on 17% of Baseline probes, and 33% of MP/MT probes. It was apparent that Oliver's previous experience with a spoon interfered with his performance of Task 7 because he lifted the spoon to his mouth during the Baseline, MT, and MP/MT. This error also occurred for Task 3, but only during the Baseline and MT phases.

Ann (see Table 2, Task 7) and Hal (Table 3, Task 7) improved their level 2 performance scores on Task 7 during the MP/MT phases to 100% (from Baseline scores of 67% for Ann and 17% for Hal). Ann most often picked up the spoon in Baseline without releasing it, but she also pushed the utensil holder away. This pushing behavior was also evident in the Baseline of Task 1 where she pushed away the jar. During MT and MP/MT, Ann most often lifted and dropped the spoon as she had done with the toothbrush for Tasks 1 and 4.

Hal (see Table 3, Task 7) imitated Task 7 better than he imitated any other task during the MP/MT phase. This was the only task similar to the trained tasks that Hal improved imitation of. His previous experience with a spoon was also evident as he lifted it to his mouth on the last two MP/MT probes. There appeared to be little comparison with the performance of Task 1 since he touched or lifted the spoon on all but one Task 7 probe. If he were generalizing from Task 1 to Task 7, he would more likely have touched the utensil holder as he had touched the jar in Task 1.

It is interesting to compare Hal's performance on Task 7 with that of Task 3 (both of which required the lifting of

a spoon). Hal touched the spoon on only 4% of trials for Task 3, yet he was able to lift the spoon on 90% of probes for Task 7. The spoon might have been easier to see and reach when it was placed on the table (as it was for Task 7), than it was when it was placed within the silverware tray during the Task 3 presentations.

Alex (see Table 4, Task 7) did not improve his imitation of Task 7. He increased the percent of trials scored at performance levels 0 (from 17% during the Baseline to 33% in MP/MT) and 1 (from 17% during the Baseline to 67% in MP/MT), and he decreased the percent of trials scored at performance level 2 in MP/MT from 67% to 0%. Alex most often lifted and threw the spoon in Baseline, but only touched the spoon in MP/MT. This change in errors was not comparable to changes in errors for Tasks 1 or 4.

Ann had similar errors for Tasks 1, 4, and 7 throughout the study. Her most prevalent error during the Baseline for these three tasks (pushing the materials away) changed following the Baseline. During MT and MP/MT, Ann most often lifted and dropped the toothbrush for Tasks 1 and 4, and the spoon for Task 7. There did not appear to be any similarities between the errors of Tasks 1 and 7, or Tasks 4 and 7 for Hal, Oliver, or Alex.

Task 8 - Tasks 2 and 5 were similar to Task 8 in the motor movements required to move the materials. All three tasks required the students to remove a lid from a container and place it on the table. The materials used for Task 8

were different than those used for Tasks 2 and 5 (see the Appendix for a detailed description of the tasks).

Imitation of Tasks 2 and 5 required that the students remove a lid from a pan and place it on the table. Task 8 required that the students lift a lid from a thermos and place it on the table. The student had to lift the cup by the handle on the side of the cup.

The same method of scoring was used for Tasks 2, 5, and 8. On Task 8, the students received a performance level score of 1 if they touched any part of the lid, 2 if they grasped the handle and lifted the lid from the thermos, 3 if they placed the cup on the table, and 4 if they released the cup. They received a performance level score of 0 if they did not touch the thermos lid within 10 seconds of the task command.

Ann (see Table 2, Task 8) was the only student to improve her imitation of Task 8. She received a performance level score of 2 on the MT probe, and on 67% percent of probes in MP/MT (compared to 0% in Baseline). As for Task 2, she most often pushed the thermos away during the Baseline, and lifted the cup by the handle without setting it down in MT and MP/MT. Similar errors occurred for Tasks 5 and 8 in the Baseline (pushing the pan and thermos away), but there was no relation between errors in MT or MP/MT.

Hal (see Table 3, Task 8) and Oliver (see Table 5, Task 8) did not improve their imitations of Task 8. They had no change in the percent of probes at each performance level in

Baseline and MP/MT. Hal scored performance level 0 on every probe although he always reached towards the thermos. This differed from Tasks 2 and 3 where he stopped reaching towards the materials in MP/MT. There were no comparisons between Hal's errors on Tasks 2 and 8, or Tasks 5 and 8.

Oliver (see Table 5, Task 8) scored 67% of probes at performance level 1, and 33% of probes at performance level 0 during both the Baseline and MP/MT. He also scored performance level 0 in MT. He did, however, grasp the handle of the lid (rather than just touching it) more often in MT and MP/MT. There were no comparisons between Oliver's errors in performance for Tasks 2 and 8, but he either lifted without setting down the lids, or touched the handles for Tasks 5 and 8 during Baseline and MP/MT.

Alex (see Table 4, Task 8) was the only student to perform all of Task 8 on any probe during the study. He imitated Task 8 perfectly on the first Baseline probe, but did not replicate this performance on any following probe. Instead, his performance level scores of 4 decreased from 17% to 0%, and performance level scores of 2 decreased from 50% to 33%. Performance level scores of 0 increased from 0% during Baseline to 33% during MP/MT.

Alex performed the same type of error during MP/MT for Tasks 2, 5, 8, and 9. He began to lift and transfer the lid in Task 2 to his other hand. This behavior initially occurred about half-way through MP/MT for Task 2. On generalization task probes following having transferred the

lid, Alex transferred the materials of Tasks 5, 8, and 9. He appeared to generalize this behavior to similar tasks (with the exception of Task 9).

Similarities were evident between the errors of Tasks 2 and 5, and Tasks 5 and 8 for Ann during the Baseline. Ann also had similar errors on Tasks 2 and 8 throughout the study. Alex had similar errors on Tasks 2, 5, 8, and 9 in MP/MT. Hal had no similar errors on Tasks 2, 5, or 8 during Baseline and MT. During MP/MT, Hal did not touch the handle for either Task 2 or 5. Oliver had similar errors for Tasks 5 and 8 during MP/MT.

Task 9 - Task 9 was similar to Tasks 3 and 6 in the motor movements used to complete the task. All three tasks required the movement of an object from within a container to the table (see the Appendix for a detailed description of the tasks).

The same method of scoring was used for Tasks 3, 6, and 9. On Task 9, the students received a performance level score of 1 if they touched the apple juice box, 2 if they lifted the juice box, 3 if they placed the box of apple juice on the table, and 4 if they released the box of juice. They received a performance level score of 0 if they did not touch the box of juice within 10 seconds of the task command.

Two students improved their imitation of Task 9. Alex (see Table 4, Task 9) increased the percent of probes scored at performance level 2 in MP/MT compared to Baseline

percentages (from 17% to 33%). Oliver increased his performance level scores of 2 from 17% during the Baseline to 67% during MP/MT.

Alex had performance similarities between Tasks 6 and 9 in Baseline, MT, and MP/MT. He most frequently touched the hairbrush (Task 6) and the apple juice (Task 9) during the Baseline and MT. In MP/MT, he most often lifted the hairbrush and the apple juice. There was no relationship between the most common errors performed for Tasks 3 and 6, or Tasks 3 and 9.

Oliver made the same type of errors on Tasks 3, 6, and 9 in all three phases. During Baseline and MT, he most often pushed the containers away. In MP/MT, he continued to push the containers but he also began to lift and throw the spoon (Task 3), the hairbrush (Task 6), and the box of apple juice (Task 9). It was unfortunate that Oliver generalized this particular behavior between similar tasks.

Ann (see Table 2, Task 9) and Hal (see Table 3, Task 9) did not improve their imitation of Task 9. Ann decreased the percent of probes at performance level 4 from 67% during the Baseline to 33% in MP/MT. Hal increased the percent of probes scored at performance level 0 from 67% during the Baseline to 100% during MP/MT. Hal did not touch either the lunchkit or the box of juice in MP/MT as he had in the Baseline. This lack of movement towards the objects is also evident for Hal on Tasks 2, 3, and 5 in MP/MT.

Ann (see Table 2, Task 9) had more complete imitations of Task 9 (performance level scores of 4) than on any other task in the study. Unfortunately, she decreased the number of complete imitations of Task 9 in MP/MT compared to complete imitations during Baseline. Although she continued to lift the box of juice from the lunchkit, she either dropped it a short distance to the table or did not set it down. She had also more frequently dropped the spoon to the table in Task 3 during MP/MT.

There were similarities in errors on Tasks 3, 6, and 9 for Oliver throughout the study. Ann had similar errors on Tasks 3 and 6 in Baseline and MT. Alex had similar errors for Tasks 6 and 9 throughout the study, and Tasks 3, 6, and 9 during MP/MT. Ann also had similar errors for Tasks 3, 6, and 9 during MP/MT. No similarities between errors of Tasks 3, 6, and 9 were evident for Hal.

Hypothesis IIc (Tasks 10-12) - Students will not generalize a learned imitative response to untrained tasks (Tasks 10-12) with both different materials and motor movements than those in previously imitated tasks (Tasks 1-3).

The students improved their performance on a total of 5/12 generalization tasks having both different materials and motor movements than the trained tasks. Students did not improve performance of tasks having both different materials and movements (Tasks 10-12) as well as they improved performance of tasks having similar materials and/or motor movements (Tasks 4-9). No student improved performance of

all three tasks using different materials and motor movements (Tasks 10-12). Hal improved imitation of Task 10. Ann improved imitation of Task 11. Hal, Alex, and Oliver improved imitation of Task 12.

Task 10 - Task 10 used materials and motor movements that differed from all of the other tasks. The grasp required to lift the bowl varied from the the grasp required to lift the other materials.

Imitation of Task 10 required the students to place one bowl on top of an identical bowl. They had to lift the bowl which was directly in front of the hand they used to lift the bowl. For example, if a student lifted with his right hand he could not reach across to the left bowl. If the student lifted with their right hand, they were required to lift the right bowl (see the Appendix for a detailed description of the tasks).

The students received a performance level score of 1 if they touched the bowl in front of the hand they used, 2 if they lifted the appropriate bowl, 3 if they placed the lifted bowl on top of the second bowl, and 4 if they released one bowl onto the other. They received a performance level score of 0 if they did not touch the bowl (directly in front of the hand they used to touch it) within 10 seconds of the task command.

One student improved his performance of Task 10 when MP/MT scores were compared to Baseline scores. Hal (see Table 3, Task 10) increased the percent of probes scored at

performance level 2 from 17% to 67%, and decreased the percent of probes scored at performance level 0 from 17% to 0%. During the Baseline, he most often touched the appropriate bowl without lifting it. However, during the MP/MT phase, he began to lift the bowl (performance level 2).

Oliver (see Table 5, Task 10) and Ann (see Table 2, Task 10) had similar decreases in their imitations of Task 10. Oliver decreased the percent of probes scored at performance levels 0, 1, and 3 during the Baseline (from 17%, 33%, and 17%, respectively) to 0% in MP/MT. He also increased the percent of probes scored at performance level 2 during MP/MT to 100% from 33% in the Baseline. Ann also decreased the percent of probes scored at performance levels 0 and 3 from 17% during the Baseline to 0% in MP/MT, and increased the percent of probes at performance levels 1 and 2 (from 50% and 17% during Baseline to 67% and 33% during MP/MT). Both Ann and Oliver scored performance level 3 on 17% of probes in Baseline, but only scored as high as performance level 2 in MT and MP/MT. Both students most often touched or lifted the bowl without placing it into the second bowl. During MT and MP/MT, Oliver lifted the bowl and handed it to the instructor.

Alex (see Table 4, Task 10) scored performance level 2 on every probe for imitation of Task 10 and, therefore, did not improve imitation of this task. Even though he always lifted one bowl without setting it into the second bowl,

there were variations in his errors. During Baseline, he most often lifted and threw the bowl. In MT and MP/MT, he most often lifted the bowl without throwing it.

There was no relationship between Task 10 errors and the other tasks for Ann or Oliver. Alex made similar errors for Tasks 1, 7, and 10 in Baseline (lifting and throwing), but not in MT or MP/MT. Hal also made similar errors for Tasks 10 and 12 in the Baseline (touching without lifting), but not in MT or MP/MT.

Task 11 - Task 11 used materials and motor movements that differed from all of the other tasks. No other task involved the pouring of a substance into a container (see Appendix A for a detailed description of the tasks).

Scoring on Task 11 varied from the scoring of other tasks in that a performance level 2 score required a lifting and pouring movement. On all other tasks lifting the appropriate object or part of an object was equal to a performance level 2 score. It was still possible, however, to assess changes in the performance of this task.

The students received a performance level score of 1 if they touched the cereal box, 2 if they lifted and poured any amount of cereal into the bowl, 3 if they placed the box onto the table, and 4 if they released the cereal box. They received a performance level score of 0 if they did not touch the cereal box within 10 seconds of the task command.

One student improved performance of Task 11 when the percent of probes scored during the Baseline was compared to

MP/MT scores. Ann (see Table 2, Task 11) increased the percent of performance level 1 scores during MP/MT from 33% to 67%, and decreased the percent of probes scored at performance level 0 from 67% to 33%. Although she lifted the box of cereal, she never poured any cereal into the bowl.

Oliver (see Table 5, Task 11) did not improve his performance of Task 11. He decreased the percent of probes scoring performance level 2 from 17% to 0%, and increased the percent of probes scored at performance level 1 from 50% to 67%. Although Oliver poured cereal into the bowl on 17% of probes in the Baseline (performance level 2), he never replicated this performance of Task 11 during MT or MP/MT.

Hal (see Table 3, Task 11) and Alex (see Table 4, Task 11) did not improve their performance of Task 11. They both scored the same percent of probes at each performance level during the Baseline and MP/MT. Hal scored performance level 0 on every probe. He most often touched or lifted the bowl as he did for Task 10.

Alex (see Table 4, Task 11) maintained the same percent of probes at performance level 0 (33%) and performance level 1 (67%) during both the Baseline and MP/MT. He most often touched or lifted the box during all three phases of the study.

There was no relation between errors of Task 11 and any other task for Alex, Ann, or Hal. Oliver had similar lifting errors for Tasks 2 and 11 during the Baseline, but there was no relation between errors of these tasks in MT or MP/MT.

Task 12 - Task 12 differed in both materials and motor movements from all other tasks. Imitation of Task 12 required the students to place a slice of bread into a toaster (see the Appendix for a detailed description of the tasks).

Students received a performance level score of 1 if they touched the slice of bread, 2 if they lifted the bread from the table, 3 if they placed any part of the bread into either toaster slot, and 4 if they released the bread and it remained partly in the toaster slot. If the student did not touch the bread within 10 seconds of the task command, they received a performance level score of 0.

Three students improved their performance of Task 12 when Baseline scores were compared to MP/MT scores. Hal (see Table 3, Task 12), Alex (see Table 4, Task 12), and Oliver (see Table 5, Task 12) improved their performance level 2 scores following the Baseline. Hal improved his performance level 2 score from 50% during the Baseline to 67% in MP/MT. Alex improved his performance level 2 score from 50% during the Baseline to 100% in MP/MT, and Oliver improved his performance level 2 score from 33% during the Baseline to 67% in MP/MT. All three students' most frequent error during Baseline was to touch the toaster. During MP/MT, these three students most frequently lifted the slice of bread (sometimes to their mouth).

Ann (see Table 2, Task 12) did not improve her imitation of Task 12. She decreased her performance level 2

scores from 50% in the Baseline to 33% in MP/MT. During the Baseline, she had most often touched or lifted the bread, but in MP/MT she most often pushed the toaster away. On all other tasks where Ann had pushed the materials away, the incidence of pushing away decreased in MP/MT. Task 12 was the only task on which she increased the incidence of pushing materials in MP/MT.

There was no relation between errors on Task 12 with Tasks 1-11 for Oliver, Hal, or Alex. Ann had similar lifting errors for Tasks 1, 7, and 12 during the Baseline, but there was no relation between errors in MT or MP/MT.

D. Within Sessions Comparison

Following the completion of the study, an analysis was made to evaluate two factors that may have influenced each student's acquisition of imitation and generalization of the imitative response. A comparison of each student's response to their name was done to evaluate whether this was a factor in their imitation learning. The sequence of trial presentations and resulting trial scores were also compared to evaluate the effectiveness of distributed trial sequencing. An informal evaluation of Ann's handedness occurred throughout the study.

Response to Name

Bricker et al. (1980) and Streifel (1974) stated that students must have the prerequisite skill of making eye-contact with the model in response to the calling of

their name before they can be taught to imitate. This hypothesis was not supported by the findings of this study. The student with the highest percent of responses to his name improved imitation of the fewest tasks.

Hal responded with eye-contact 84% of the time after his name was called. He improved imitation on only 5/12 tasks. Oliver and Alex improved imitation of 7/12 tasks, but Oliver established eye-contact on 68% of trials while Alex established eye-contact on only 36% of trials. Ann, who had improved imitation on the most tasks (9/12), established eye-contact on only 50% of trials.

Distributed Trial Presentations

Distributed trial presentations have been reported in the literature to improve generalization and to overcome some of the problems associated with massed trial presentations. Sailor et al. (1983) stated that one problem with massed trials was the deceleration of performance over the training session. This deceleration of performance may be caused by fatigue, boredom, and/or reinforcer satiation. Performance during massed trials generally increases during initial trials, then plateaus at the student's competency level, and finally decreases as the session progresses.

Four types of trial sequences may have occurred during each training session for Tasks 1-3. The first type, massed presentation, occurred when three trials of any task were presented consecutively within one session. Unfortunately, in the random presentation order that was determined for

trial presentations, Task 3 was never presented in a massed trial sequence.

The second type of presentation occurred when three trials of a task were distributed throughout the session so that the other two tasks were presented between these trials. Task 2 occurs in a distributed trial presentation in the following sequence: 2, 3, 2, 1, 1, 1, 3, 2, 3.

There were also two possible presentations using massed and distributed sequences. Massed-distributed presentations were presented as Task 3 is in the following sequence: 1, 3, 3, 2, 1, 2, 3, 1, 2. Distributed-massed presentations were presented as Task 1 is in the following sequence: 1, 3, 2, 2, 1, 1, 3, 2, 3.

The average scores for the second and third presentations of each task (Tasks 1-3) were compared for each student under each type of trial presentation. The best sequence for each task is displayed in Table 6.

STUDENT	BEST TRIAL PRESENTATION FOR TASKS 1, 2, and 3			
	MASSED	DISTRIB./MASSED	MASSED/DISTRIB.	DISTRIBUTED
Ann	-	1,2,3	-	-
Hal	1	-	2,3	1
Alex	1	2	3	-
Oliver	1	3	2	1

Table 6: Massed vs. Distributed Trial Presentation

Distributed-massed or massed-distributed trial sequences were the most effective for all three students. Ann was the only student for whom one trial sequence (distributed-massed) was superior to any other sequence for all three tasks. Massed and distributed were equally effective on Task 1 for Hal and Oliver. Distributed was the least effective trial sequence.

The totals of the initial trial presentations (trials 1-3), the medial trials (trials 4-6), and the final trial presentations (trials 5-9) were compared for each student (see Figure 3). No student exhibited the deceleration of performance often associated with massed trial sequencing.

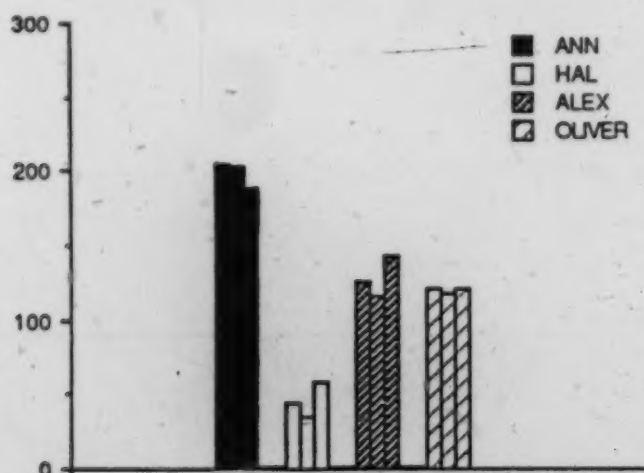


Figure 3: Total Training Task Scores on Initial, Medial, & Final Trial Presentations

Three students increased their performance level scores during the final trial presentations, and had higher initial trial scores than medial trial scores. This pattern is the

opposite of the previously described sequence of performance associated with massed trial sequencing. Ann's performance level scores were lowest during the final trials with a small difference between the first six trials.

If a warmup was required to improve performance, the first presentation of a task would be performed at a lower performance level than the second, and the second would be lower than the third. This was compared for each student by totalling the first, second, and the third presentation scores of Tasks 1-3 (see Figure 4).

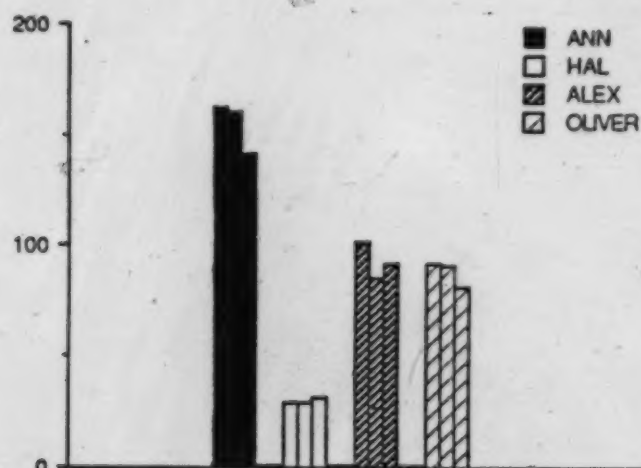


Figure 4: Total Training Task Scores on 1st, 2nd, & 3rd Trial Presentations

Practice did not appear to be a factor in task performance scores for Ann, Alex or Oliver. None of these scores increased as the tasks were presented. Hal was the only student to improve his score by a very small amount on the last task presentation.

The most effective trial sequence to use for training imitation appears to be a combination of massed-distributed and distributed-massed trial presentations. The absence of decreasing performance throughout the session also supports the use of distributed trial presentations rather than massed trial presentations.

Ann's Handedness

An informal evaluation of Ann's hand preference found that Ann used her right hand 62% of the time during Baseline, 75% during MT, and 76% during MP/MT. This indicated that Ann predominantly used her right hand. This observation was contrary to her teacher's indication that Ann most often used her left hand.

VI. DISCUSSION

The results of this study do not conclusively demonstrate that imitation training caused the changes in student performance of the initially trained tasks and the generalization tasks. The AB experimental design that was used for this study does not control for three threats to internal validity - history, maturation, and the effects of repeated testing. However, consistent changes of the treatment effects across four students having differences in age, programs, and residences would seem to indicate that changes in performance were likely due to the experimental intervention (imitation training) rather than to history, maturation, or testing.

A. Acquisition

This study found that students concurrently taught to imitate the models of three tasks varying in materials and motor movements improved their performance of those tasks. However, no student consistently imitated the training tasks in their entirety. Small increases in the percent of complete imitations of training tasks did occur during the MT and MP/MT instructional phases. The occurrence of complete imitations of trained tasks varied from 2% to 17% of the MP/MT trials.

These results vary from the results of other imitation studies conducted with persons with severe handicaps. Previous research (Bucher et al., 1974; DeHaven, 1981;

Furnell et al., 1981; 1976) demonstrated that persons with severe mental retardation learned to completely imitate modelled tasks that were taught concurrently. Most of the tasks taught by these researchers were simple tasks such as patting one's cheeks (Furnell et al., 1981), tapping one's head (Bucher et al., 1974), or leaning from front to back (DeHaven, 1981). The most complex task taught in any of these studies was the placement of a yellow circle into a formboard (Furnell et al., 1981).

Even though students in this study did not consistently complete imitations of any of the training tasks, they did improve their performance of the training tasks. The five level performance scoring system evaluated improvements in partial imitation of tasks. Thus, it was possible to evaluate small changes in task performance if a student did not completely imitate the model of the task.

The performance level scoring system used in this study was similar to one used by Gow et al. (1985) to assess maintainance of imitated tasks. An evaluation of the percent of completed task analysis steps was used to determine if the subjects had maintained their performance of previously imitated tasks.

Since imitation was used in the present study to teach a variety of tasks with differing response requirements, an assessment procedure that evaluated relatively small changes in imitative performance was beneficial. For example, even though Hal never completely imitated any of the tasks, it

was possible to evaluate his improvements in task imitation by examining the changes in task performance levels 0-2. In addition, it was possible to assess performance improvements before a student began to completely imitate a task. For example, Ann exhibited a learning progression through the performance levels 2-4 on one training task. Even though she did not completely imitate this task until MP/MT, it was evident that she was learning to more closely approximate performance of the entire task.

B. Generalization

This study found that students with severe handicaps were more likely to improve performance on untrained tasks that had materials and motor movements similar to the initially trained tasks. As the untrained tasks increasingly varied from the trained tasks in terms of materials and motor movements, students were less likely to improve their performance of those untrained tasks.

Since persons with severe handicaps have been shown to have difficulty generalizing behavior from trained to untrained tasks (Gaylord-Ross et al., 1985), the results of this study are promising. All students (except for Hal who did not improve performance on tasks with similar materials and motor movements) generalized to all three types of generalization tasks (those with similar materials and motor movements, different materials but similar motor movements, and different materials and motor movements than the trained

tasks).

The students most often improved performance of generalization tasks that had materials and motor movements similar to those of the initially trained tasks. The students least often improved performance of generalization tasks having materials and motor movements that differed from the initially trained tasks. Generalization tasks with motor movements similar to (but materials different from) the initially trained tasks were more often improved than generalization tasks with materials and motor movements different than the trained tasks, but less often improved than generalization tasks with materials and motor movements similar to the trained tasks.

These results support the findings of Steinman (1970a) and Garcia et al. (1971) who found that subjects with severe handicaps were more likely to imitate untrained tasks with motor movements similar to trained tasks than they were to imitate untrained tasks with motor movements that varied from the trained tasks. The present study found that when generalization tasks with motor movements similar to the trained tasks were compared to generalization tasks with motor movements that varied from the trained tasks, students most often improved performance of generalization tasks with similar motor movements. As the response requirements for the generalization tasks increasingly varied from the trained tasks, students were less likely to generalize to the untrained tasks.

This study also found that students were more likely to improve performance of generalization tasks that had materials similar to the trained tasks than if the generalization tasks varied in materials from the trained tasks. Livi et al. (1985) and Gow et al. (1986) suggested that generalization from trained to untrained tasks would increase if untrained tasks shared common stimulus features with trained tasks.

When both the stimulus and response features of the generalization tasks varied from the trained tasks, the least amount of generalization occurred. The students were least likely to improve their performance on generalization tasks that varied from the trained tasks in both materials and motor movements.

Pancsofar & Bates (1985) found that students taught to perform tasks using two exemplars with similar materials generalized behavior to tasks with changes in stimulus features, but did not generalize behavior to tasks requiring different responses. When these students were taught to perform tasks requiring two different responses, they generalized to tasks with variations in responses. Since the materials used in the study by Pancsofar et al. (1986) were soap dispensers, one must assume that if the response requirements of the tasks varied, the stimulus features must have as well. Therefore, teaching task performance with exemplars that varied in both stimulus and response features increased generalization to tasks varying in both stimulus

and response features.

Giangreco (1985) also found that a boy with profound retardation generalized imitation to functional tasks requiring different motor movements and using different objects than the trained tasks. The present study found that students were least likely to generalize imitation to untrained tasks varying from the trained tasks in materials and motor movements. However, all of the students did improve imitation of at least one generalization task that varied from the trained tasks in materials and motor movements.

Generalization of performance from tasks trained by modelling and prompting to untrained modelled tasks was improved if the untrained tasks shared common stimulus and response features. Since generalization of imitation is dependent upon the relevant features of the tasks taught, teaching imitative behavior without teaching functional tasks does not seem appropriate. If, for example, a student is taught to imitate touching one's head, or moving one's arms, it cannot be assumed that this behavior will generalize to other tasks which are not similar in stimulus or response features. Therefore, unless the intention is to teach a repertoire of head touching or arm waving to the student, the efforts required to teach this imitative behavior would be better utilized training imitation of functional tasks.

Although all students improved their performances of both training and generalization tasks, variations in results across subjects and tasks were evident.

C. Differences Across Subjects

The students in this study had notable differences in task performance. Individual differences were evident in baseline performance scores, the highest performance levels scored throughout the study, the number and type of tasks on which performance improved, and the errors committed by each student.

During the baseline, three students completely imitated at least one task on at least one trial. One student completely imitated the model of three generalization tasks. In contrast, one student only scored as high as performance level 2 (lifting the relevant part of the task) during the baseline.

The students who had completely modelled a task during the baseline either increased the number of tasks completely imitated, or maintained the same number of completely imitated tasks following the baseline. Although the number of tasks completely imitated did not decrease, those tasks completely imitated in MT and MP/MT were not necessarily the same tasks completely imitated during the baseline. Completed imitations, however, did not occur consistently on any task by any student during Baseline, MT, or MP/MT.

The student that had not completely imitated any task during the Baseline did not completely imitate any task in the MT or MP/MT phases. During these phases, he decreased the number of tasks that he performed at performance level 2 (his highest baseline performance level score). Only the students who completely imitated tasks during the baseline, completely imitated tasks following the baseline.

There were differences in the number of training and generalization tasks improved by each student. Three students most often improved performance of the training tasks, and improved performance of fewer generalization tasks as more variation in stimulus and response features was introduced. One student best improved performance of the training tasks and the generalization tasks that had materials and motor movements that varied from the trained tasks. It appeared that this student may have been confused by the similar features of tasks, and that he improved performance on those tasks that varied the most from the trained tasks. The position of the materials may also have been a factor in this student's task performance. If the task used materials that were initially placed apart (as the toothbrush was initially placed before placing it into the jar or can), the student was more likely to manipulate the appropriate material. If the task required that the student remove some part of the materials (such as the removal of the spoon from the silverware tray), he was less likely to improve his performance of that task. On some tasks that

required the removal of materials, this student stopped manipulating any part of the materials during MP/MT.

Some students generalized errors across tasks that required similar motor movements. Oliver began to throw or push the materials off of his tray for Tasks 3, 6, and 9 during Baseline, and continued this behavior during the MT and MP/MT phases. Alex began to transfer materials from one hand to the other for Tasks 2, 5, 8, and 9 in MP/MT. Ann had similar lifting and dropping errors for Tasks 1, 4, and 7. No consistent performance errors occurred for any one group of similar tasks for all of the students.

D. Differences Across Tasks

Performance of every task was improved by at least one student. Thus, it was not possible to determine the most difficult tasks by the lack of improved performance by all students. The relative difficulty of task performance, however, could be determined by the differences in the overall levels of performance of each task, and in the number of students improving performances of each task.

Although not all students improved their performances of all training tasks, every student improved his/her performance of at least two of the three training tasks. Only tasks taught with modelling and prompting were improved by all four students. Improved performance did not occur for all four students on any one generalization task.

Some parts of tasks appeared to be easier for the students to perform than others. If materials were initially separated, and one object was manipulated, the students were more likely to improve performance. If one object was contained within the other, students also improved their performance of these tasks. If the object to be manipulated was part of a larger object, students had difficulty performing these tasks.

Students most often improved performance on Tasks 1, 4, and 7. These tasks required the students to lift an object from the table, and place it into a container. Although the students had difficulty placing the objects into the containers, they improved in their ability to consistently lift or touch the correct object.

Students were next most likely to improve performance on Tasks 3, 6, and 9. These tasks required the students to remove a separate object from within a container, and place it onto the table. Similar errors on tasks with similar motor movements most often occurred on Tasks 3, 6, and 9.

The students were least likely to improve on tasks 2, 5, and 8. (Even the generalization tasks with varying materials and motor movements were more likely to be improved.) These tasks required the students to grasp a part of an object that was part of a larger object (either a lid on a pan or a thermos), remove the lid, and place it onto the table.

Similarities in errors between generalization tasks with different materials and motor movements and any other task occurred only during the Baseline. These similar errors did not occur in MT or MP/MT.

One step of the tasks that was easy for the students to perform was the release of the object. The difference between a performance level score of 3 and 4 was the release of the object after it was correctly placed. If students correctly placed the object, they almost always released the object within the 10 second response time.

Differences in the relative difficulty of tasks was also evident in the highest performance levels scored for each task. The most difficult tasks appeared to be Task 8 (removal of a thermos lid) and 11 (pouring cereal into a bowl). No student scored above performance level 2 on either of these tasks, and one student never scored above performance level 0 on only these two tasks. Task 1 (placing a toothbrush into a jar), Task 4 (placing a toothbrush into a can), and Task 12 (placing bread into a toaster) were never scored above performance level 2 by any student (except that Oliver scored performance level 3 on one trial for Task 1).

There were differences between improved performance and overall performance of the tasks. Although Tasks 1 and 4 were most often improved, they were not the best performed tasks. Tasks 2 and 3 were performed at the highest performance levels, but were not the tasks most often

improved by the students.

E. Trial Sequencing

The concurrent, distributed trial presentation of training tasks during sessions appears to have been a contributing factor in the generalization of improved performance of untrained modelled tasks. Anderson et al. (1980), Panyan et al. (1978), and Waldo et al. (1982) found that teaching students using concurrent trial sequencing promoted generalized performance.

Distributed trial presentations have been shown to be more effective than massed trials for promoting student performance. Students more often increased the number of correct responses during distributed trial presentations (Dunlap & Koegel, 1980; Mulligan, Lacy, & Guess, 1982). Distributed trial presentations were also better than massed trial presentations for motor and cognitive tasks (Mulligan, Guess, Holvoet, & Brown, 1980).

This study found that student performance was maintained or increased as the trials for each session progressed. Although a total of 18 models were prompted during each MP/MT session, the students' performance did not decelerate as would have been expected if a massed-trial presentation had been used (Sailor et al., 1983).

Differences in trial presentations within sessions, however, resulted in differences in student performance. Students performed tasks at the highest performance levels

when the tasks were presented in a massed-distributed or distributed-massed format. If tasks were presented in a distributed trial format, the students performed tasks at lower performance levels. Massed trial presentations were not as effective as massed-distributed or distributed-massed, but were more effective than distributed trials alone.

Performance of tasks may have been improved by altering the trial presentation formats dependent upon student performance. Baine (1982) suggested using massed trials during acquisition to establish new responses, and then distributing trials to maintain the behavior. Thus, students would have initially been taught using a massed trial format. When performance improved, students would have been taught using massed-distributed or distributed-massed trial presentations.

F. Prerequisite Skills for Imitation

This study found that students responding with eye-contact to the instructor calling their name was not a prerequisite for improved imitation as suggested by Streifel (1974) and Bricker et al. (1978). The student with the lowest percent of eye-contact responses improved performance on the most tasks. As well, the student that responded with the highest percent of eye-contact responses improved performance of the fewest number of tasks when compared to the other students.

Other prerequisite attending behaviors (such as remaining seated and looking at objects) as outlined by Streifel (1974) may not be required prior to imitation training, but may be taught during imitation training. During this study, the students were prompted to look at the materials with a signal - "Ready". They were also required to look at the materials prior to the model of the task. If students did not remain seated, they were prompted to be seated prior to the continuation of the sessions.

Minimal prerequisite behaviors for imitation training are difficult to determine. It appears that the physical ability to manipulate the materials and vision adequate to view the modelled task are two prerequisites. The students in this study (all of whom met these two prerequisites) improved performance of at least 5/12 training and generalization tasks when taught to model the performance of three training tasks.

It may, however, be possible to adapt tasks for students with physical disabilities by changing the physical requirements of the task or by adapting materials so that the student can manipulate them. It is the opinion of the author that one of the students who was not included in the study because of problems manipulating the materials could have improved imitation of the tasks if the end result of the behavior, rather than the process of imitation, were evaluated. For example, this student may not have lifted the toothbrush in the same manner as the model, but she may have

been able to place it into the jar.

Modelling and physical prompting may also teach a student to move and manipulate materials in ways that had not been observed prior to imitation training. For example, Hal had never touched the spoon in the silverware tray during the baseline, but began to during MT and MP/MT.

G. Modelling as a Teaching Strategy

Teachers of students with severe handicaps must choose instructional techniques that will facilitate learning and promote generalization (Sailor et al., 1983). Previous research has outlined the following instructional techniques that have enhanced learning and generalization of learning for students with severe handicaps. These included:

1. choosing functional, age appropriate tasks to teach (Berman et al., 1984; Horner et al., 1982),
2. using a concurrent sequence of instruction so that the students receive a number of trials of various tasks interspersed with other tasks (Anderson et al., 1980);
3. using the most powerful reinforcers to reinforce closer approximations of task performance (Snell et al., 1978),
4. prompting the students to perform tasks using the least intrusive prompts to insure that the students perform the behavior with the fewest errors (Foxx, 1982),
5. fading the prompts as soon as the students perform the behavior and using the least-intrusive prompt (Foxx, 1982),

6. using signals for attention (such as "Ready" was used in this study), and signals for beginning the task (Baine, 1982),
7. teaching a number of exemplars of a task (Gannon, 1986; Stokes et al., 1977),
8. teaching examples that sample the range of stimulus and response demands of each task (Day & Horner, 1986; Horner et al., 1982), and
9. teaching generalized learning strategies that can be used with a number of tasks (Gow et al., 1986; Manion & Bucher, 1986; Sprague & Horner, 1984).

An exciting possibility also exists for peers of the students with handicaps to become models. Research has shown that peer tutors can be effective teachers of social responses for handicapped students (Fox, Gunter, Brady, Bambara, Spiegel-McGill, & Shores, 1984; Lancioni, 1982; Strain, Kerr & Ragland, 1979). If peer tutors were to use imitation as a method of instruction for all programs, the possibility exists that handicapped students might generalize from the imitation instruction to appropriate social behaviors.

This study found that acquisition and generalization of task performance could be achieved by:

1. concurrently teaching by modelling and prompting three functional tasks varying in materials and motor movements,
2. using a model-prompt/model-test instructional procedure

rather than a model-test procedure,

3. using massed-distributed or distributed-massed trial presentations within sessions, and
4. assessing task performance using a performance level scoring system.

H. Future Research

Further research is required to evaluate imitation as an instructional technique for teaching a variety of functional tasks that might vary in both stimulus and response features. It is also necessary to investigate the relative importance of both stimulus and response variations. Further evaluation is also required to determine if initial imitation training would improve the acquisition of similar tasks taught by modelling and prompting. Multiple baseline experimental designs will also increase the evidence supporting the use of imitation as a generalized learning strategy for teaching students with severe handicaps.

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VIII. APPENDIX

Task 1 - Toothbrush in a Jar

Materials: clear glass jar (16 cm. high, opening measured 8 cm. across); pink toothbrush (16 cm. long, 1.4 cm. wide)

Presentation: The jar was placed on the table in front of the student. The toothbrush was placed in front of the student's dominant hand. The handle of the toothbrush faced the student and the bristles faced upwards.

Model: The toothbrush was picked up by the handle using one hand. The toothbrush was placed inside of the jar with the bristles facing downwards and was released.

Performance Level Scores:

Level 0 - The student did not touch the toothbrush.

Level 1 - The student touched the toothbrush.

Level 2 - The student picked up the toothbrush by the handle using one hand.

Level 3 - The student placed any part of the bristled-end of the toothbrush inside the opening of the jar.

Level 4 - The student released the toothbrush and the toothbrush remained inside of the jar.

Note: During the Baseline and Model-Test phases, the students were required to perform the tasks as outlined within a 10 second response time following the task command "Do this", the model of the task, and the restoration of the

materials. During the Model-Prompt/Model-Test phase, the students were required to perform the tasks as outlined within a 10 second response time following the task command "Do this", the model of the task, the restoration of the materials, and the second task command "Do it".

TASK 2 - Lid off a Large Pan

Materials: stainless steel pan with a long handle (12 cm. high, opening measured 20 cm. across, the lid fit within a 1 cm. lip on the pan); stainless steel lid (2 cm. high, 19 cm. across); black, round handle on the lid (2 cm. high, 4 cm. across)

Presentation: The pan was placed on the table in front of the student. The handle of the pan faced away from the student. The lid was placed on the pan.

Model: The handle of the lid was grasped using a pincer grasp. The lid was lifted off of the pan, and placed right-side up to the right of the pan (to the left side if the student was left-handed).

Performance Level Scores:

Level 0 - The student did not touch the handle of the lid.

Level 1 - The student touched the handle of the lid.

Level 2 - The student lifted the lid off the pan.

Level 3 - The student placed the lid of the pan right-side up on the table.

Level 4 - The student released the handle of the lid.

TASK 3 - Spoon from a Silverware Tray

Materials: silverware dessert spoon; brown, plastic silverware tray (4 cm. high, 4 lengthwise compartments - one measured 27 cm. by 6 cm, and three measured 22.5 cm. by 6 cm., one widthwise compartment measured 18 cm. by 4 cm.)

Presentation: The spoon was placed in the second lengthwise compartment (measuring 22.5 cm. by 6 cm.) from the left of the container when facing the student. The tray was placed in front of the student so that the end with the four compartments faced the student.

Model: The spoon was grasped by the handle and lifted to the side of the container. The spoon was placed on the table to the right (or to the left for the left-handed students) of the tray. The handle of the spoon faced the instructor.

Performance Level Scores:

Level 0 - The student did not touch the spoon.

Level 1 - The student touched the spoon.

Level 2 - The student placed the spoon to the right of the tray (to the left of the tray for the left-handed students). The handle of the spoon faced the student.

Level 4 - The student released the spoon.

TASK 4 - Toothbrush in a Can

Materials: black can with a pattern on the outside (12.5 cm. high, the opening measured 9 cm. across); pink toothbrush (16 cm. long, 1.4 cm. wide)

Presentation: The can was placed on the table in front of

the student. The toothbrush was placed in front of the student's dominant hand and the bristles faced upwards. The handle of the toothbrush faced the student.

Model: The toothbrush was picked up by the handle using one hand. The toothbrush was placed inside of the can with the bristles facing downwards. The toothbrush was released into the can.

Performance Level Scores:

Level 0 - The student did not touch the toothbrush.

Level 1 - The student touched the toothbrush.

Level 2 - The student picked up the toothbrush by the handle using one hand.

Level 3 - The student placed any part of the bristled-end of the toothbrush inside the opening of the jar.

Level 4 - The student released the toothbrush and the toothbrush remained inside of the jar.

TASK 5 - Lid off a Small Pan

Materials: stainless steel pan with a long handle (6.5 cm. high, opening measured 16 cm. across, the lid fit into a 1 cm. lip on the pan); stainless steel lid (2 cm. high, 15 cm across); black, round handle on the lid (2 cm. high, 4 cm. across)

Presentation: The pan was placed on the table in front of the student. The handle of the pan faced away from the student. The lid was placed on the pan.

Model: The handle of the lid was grasped using a pincer

grasp. The lid was lifted off of the pan, and placed right-side up to the right side of the pan (to the left of the pan for the left-handed students).

Performance Level Scores:

Level 0 - The student did not touch the handle.

Level 1 - The student touched the handle of the lid.

Level 2 - The student lifted the lid off the pan.

Level 3 - The student placed the lid of the pan right-side up on the table (to either side of the pan).

Level 4 - The student released the lid.

TASK 6 - Hairbrush from a Container

Materials: red, plastic hairbrush (15 cm. long, the bristles measured 8 cm. by 4 cm., the handle measured 7 cm. by 2.5 cm.); clear, plastic container (22 cm. long, 16 cm. wide, 4.5 cm. high)

Presentation: The hairbrush was placed in the center of the container. The bristles faced upwards and the handle faced the student. The container was placed on the table in front of the student so that the short end of the container faced the student.

Model: The hairbrush was grasped by the handle, lifted from the container, and placed to the right-side of the container (to the left-side for the left-handed students). The handle of the brush faced toward the student and the bristles faced upwards.

Performance Level Scores:

Level 0 - The student did not touch the hairbrush.

Level 1 - The student touched the hairbrush.

Level 2 - The student lifted the hairbrush by the handle.

Level 3 - The student placed the hairbrush to either side of the container so that the handle faced the student and the bristles faced upwards.

Level 4 - The student released the hairbrush.

TASK 7 - Spoon in the Dishwasher Utensil Tray

Materials: stainless steel dessert spoon; dishwasher utensil holder with a handle across the middle (14 cm. high, 20 cm. wide, 18 cm. across, contained 6 compartments measuring 8 cm. by 8 cm.)

Presentation: The utensil holder was placed on the table in front of the student so that the long side of the holder faced the student. The spoon was placed in front of the student's dominant hand. The handle of the spoon faced the student.

Model: The spoon was picked up by the handle using one hand. The spoon was placed in the utensil holder with the bowl of the spoon facing downwards. The spoon was released.

Performance Level Scores:

Level 0 - The student did not touch the spoon.

Level 1 - The student touched the spoon.

Level 2 - The student picked up the spoon by the handle using one hand.

Level 3 - The student placed any part of the bowl of the spoon inside of the top of the dishwasher utensil holder.

Level 4 - The student released the spoon and the spoon remained inside of the dishwasher utensil holder.

TASK 8 - Thermos Lid off a Thermos

Materials: plastic thermos (blue container, white lid measuring 7 cm. across, and 6 cm. high; lid had a round, looped handle on the side of the cup measuring 3 cm. by 3 cm.)

Presentation: The lid of the thermos was unscrewed from the thermos so that the lid could be lifted off without turning it. The handle faced parallel to the student's dominant hand.

Model: The handle of the cup was grasped using a pincer grasp. The cup was lifted off the thermos and rotated so that the cup was placed right-side up to the right (or to the left for the left-handed students) of the thermos.

Performance Level Scores:

Level 0 - The student did not touch the handle of the cup.

Level 1 - The student touched the handle of the cup.

Level 2 - The student grasped the handle and lifted the cup off the thermos.

Level 3 - The student placed the cup on the table (either on it's side, right-side up, or upside-down).

Level 4 - The student released the handle of the cup.

Task 9 - Apple Juice Box from a Lunchkit

Materials: apple juice box (250 ml.); plastic lunchkit (when opened the bottom of the lunchkit measured 8 cm. high, 13 cm. wide, and 24 cm. long)

Presentation: The box was placed on it's side in the middle of the bottom of the lunchkit. The top of the box faced away to the left-side of the lunchkit. The lunchkit was placed in front of the student so that the front of the lunchkit faced the student.

Model: The apple juice box was grasped by the side and lifted from the lunchkit. The box was placed on the table.

Performance Level Scores:

Level 0 - The student did not touch the box of juice.

Level 1 - The student touched the box of juice.

Level 2 - The student lifted the box off of the lunchkit bottom.

Level 3 - The student placed the box of juice on the table.

Level 4 - The student released the box.

TASK 10 - Bowl onto a Bowl

Materials: two identical, blue, plastic bowls (2 cm. high, 11.5 cm. across, 1 cm. lip around the edge of each bowl)

Presentation: The two bowls were placed beside each other on the table in front of the student.

Model: The bowl on the right was grasped by the edge with a pincer grasp, and placed on top of the second bowl so that the second bowl fit even with the first. (If the student was

left-handed, the left bowl was placed inside of the right bowl.)

Performance Level Scores:

Level 0 - The student did not touch the bowls.

Level 1 - The student touched the right bowl with their right hand (or the left bowl with their left hand if left-handed).

Level 2 - The student lifted the right (or the left) bowl.

Level 3 - The student touched the top of the bowl on the table with the lifted bowl.

Level 4 - The student released the bowl and the bowls were stacked one inside of the other.

TASK 11 - Cereal into a Bowl

Materials: white, plastic cereal bowl (4 cm. high, 16 cm. across); small cereal box (10 cm. high, 7 cm. across, top removed, 3/4 full of cereal)

Presentation: The cereal box was picked up by the side with a pincer grasp and tipped over the bowl until cereal poured into the bowl. Approximately one tablespoon of cereal was poured into the bowl. The box was placed on the table so that the bottom of the box touched the table.

Performance Level Scores:

Level 0 - The student did not touch the box.

Level 1 - The student touched the box of cereal.

Level 2 - The student lifted the box of cereal by the side and poured any amount of the cereal into the bowl.

Level 3 - The student replaced the box so that the bottom of the box touched the table.

Level 4 - The student released the box.

TASK 12 - Bread into a Toaster

Materials: two-slice toaster with stainless-steel sides; one piece of sliced bread

Presentation: The toaster was placed on the table in front of the student so that the end faced the student. The bread was placed in front of the student's dominant hand.

Model: The bread was picked up by the top crust and placed into the right slot (the left slot for left-handed students) on the top of the toaster.

Performance Level Scores:

Level 0 - The student did not touch the bread.

Level 1 - The student touched the bread.

Level 2 - The student lifted the bread off the table.

Level 3 - The student placed any part of the bread into the right or the left slot on the top of the toaster.

Level 4 - The student released the bread and the bread remained in the slot.